McGRAW-HILL
PUBLISHING COMPANY, INC.
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POWER

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Volume 67 New York, May 15, 1928 *Number 20*

The Service of the Salesman

THERE is no question but that salesmanship is on a higher plane than it used to be.

Fewer orders are closed through personal popularity, and there is less effort on the part of the commercial traveler to make himself welcome through burnt offerings, stories and questionable entertainment.

There is a growing appreciation of the fact that standing and influence with men who buy are more surely and permanently based upon real service rendered to them in their selection and use of the vendor's wares.

I do not underrate the value of personality, but in the long run a salesman's real hold on a line of customers will be won by the satisfactory service of the goods that he sells them and the soundness of his advice with regard to their selection and use.

A salesman may impose on the good nature or confidence of one with whom he has succeeded in ingratiating himself and oversell him or unload upon him something not the best adapted to his needs.

He will swell his month's account and think he has rendered a service to his house. But every time that customer's mind reverts to that purchase, as it repeatedly will, the salesman and his concern will be the subjects of disagreeable impressions, not conducive to further dealings.

There is nothing new in this line of thought, but there are still places to which it has not penetrated.

It was set in motion by the reason given to me a short time ago by a manufacturer's agent for letting one of his road men go.

The road man had been sent to see a prospect who was as good as sold, and instead of signing him up he told him how, by making a change, he could get along better without buying his device.

His employer said he was a better engineer than salesman and that he could not afford to pay a man to go around doing mechanical engineering gratis.

The salesman made a friend and gave a demonstration of engineering competency and professional frankness that ought to have put his concern at the top of the confidence column for that customer.

As a cog in the complex mechanism of distribution he acted most efficiently by doing as he did. Would he have served his employer more truly by being a promoter of poor engineering for the sake of making a questionable sale?

F. R. Low

The Place of Power in Industry

INDUSTRIAL engineers like to divide industry into four functions—men, money, management and machines. If the matter is considered from the power engineer's point of view, four analogous divisions appear —power, production, personnel and management. These are the headings under which all manufacturing activities may be classified, as distinct from the administration activities of finance and distribution.

The places occupied by these four functions of industry are perfectly definite. Management is the co-ordinating activity by means of which the other three divisions are caused to operate in harmony. Personnel provides the man-power or, better, the brain-power for the production and power divisions. Production converts raw materials into salable goods by means of machines. And power enables the machines to operate.

This job of enabling the machines to operate can be divided into four definite parts: Generation, transmission and application of power, and maintenance of the generating, transmitting and applying equipment. From this it is clear that the power function in industry cannot stop at the power-house walls, but must permeate the whole manufacturing organization. From the time the raw materials are received until the finished products leave the plant, power is a part of each step in manufacture. Because of this the power engineer is as vitally concerned with manufacturing as is the production engineer, but always from the angle of the economical and efficient application of power.

Lower Plant Costs

MANY are of the opinion that the first cost of future central stations must be decreased. With given pressures and temperatures the possible thermal economies of present-day cycles are known closely and the relation of permissible efficiency to coal cost is recognized. Lower power costs seem possible only through the construction of plants with a lower investment per unit of capacity.

A series of developments have already occurred, which show a trend in the right direction. For instance, the new plant of the Southern California Edison Company, with vertical condensers, has only foundation enough under the main turbine to bring the operating platform about ten feet above basement floor level. This not only saves some of the cost of foundations, but also permits the roof of the turbine room to be lower and thus saves building costs. Outdoor substations and switching stations are now common practice on many systems. The same idea has been applied in some new central stations where plenty of land is available. All switches are placed outside and the large expensive electrical bay in the power plant, which was formerly considered necessary, has been omitted in these stations where a small control room now suffices. Modern systems of hydraulic sluicing of ashes also permit lower boiler-room basements, and thus save in building cost.

The Benson boiler in Germany, recently illustrated in *Power*, stands in the open with no special boiler-room housing. Its operation will be watched with interest, for if it proves a marked success, standard boiler designs may be modified to permit similar non-housed installations. The fact that the generators of a hydro-electric plant in the South are in the open suggests that the cost of housing turbine generators may shortly be open to question.

All these ideas may seem radical to engineers, but changes in power-plant practice during the last twenty-five years have been quite as radical. Who knows what the steam power plant of 1950 will be like?

Speed Standardization

THE American Engineering Standards Committee has initiated a project for the standardization of the speeds of driven machines. When the task is completed and the results are applied in industry, there should result a considerable saving in the diversity of types of pulleys, gears, chain drives, speed reducers, and similar transmission devices that the manufacturer must produce and that the jobber must stock. It will be good for industry and will make for better engineering.

It has been suggested that speeds should be set according to the system of preferred numbers that has been so fully developed abroad, and to some extent on this side of the water. This will not be so easy, since alternating-current motors occupy so large a place in the driving of machinery. The speed of such motors is limited to a small number of physical possibilities. Preferred numbers are good, but their use is restricted to cases in which there is room for preference. In the case of alternating-current motors there is no preference. One cannot choose at will. Perhaps the available speeds can be fitted into the series of preferred numbers. If so, it will be a fortunate accident. If not, there is nothing to do but to stick to the motor speeds.

This project should be directed, not to the standardization of speeds as such, but to the fixing of standard speed ratios. Within obvious limits the actual speed of a transmission layout is immaterial. The thing that really affects the dimensions of physical parts is the speed ratio, and the sole object of standardization of this type is reduction in the variety of physical parts.

The task is in good hands, and the power engineer will await the outcome with deep interest.

When Politics Comes in Engineering Goes Out

A RECENT indictment found against the engineer is that he has fallen down on his job. Although his productive achievements are clearly visible in industry, his failures are equally evident outside. He appears to have failed in the solution of the problems that meet him as he steps out of his house in the morning, follow him through the day and plague him on his homeward trip. So says the New York *Sun* in a recent editorial.

The smoke that enshrouds our cities and is an unpardonable economic waste; the open garbage can, a token of dirty street conditions and a menace to public health; the crowded conditions on transit lines and the traffic congestion, both of which are fatiguing and wasteful of time that might be much better spent; the primitive methods of disposing of community and industrial wastes by polluting our rivers with them; steam trains still occupying our streets—these and other charges are placed against the engineer.

Those who know the engineer and his work are well aware that he is not without his limitations. However, most of the things complained of in the indictment can be eliminated by means already provided by the engi-

neer. There is no need of black smoke belching from chimneys if modern designs of furnaces are used and they are properly operated. Methods of smoke prevention have been provided by the engineer, but the enforcement of these, for the most part, is not in the hands of engineers but of politicians.

Community and industrial wastes need no longer pollute our streams—if the government so wills and the public will pay the price. Numerous examples show that steam trains with smoking locomotives need not occupy our streets. Here again, however, questions of legislation, finance and economics enter, as they do with many other things that affect human existence. Too frequently, political difficulties are the real trouble, and when politics comes in engineering goes out.

Spring Housecleaning

THIS is the time of the year when the housewife starts to clean her home thoroughly and to straighten up the yard. An operating engineer should view his power plant with a critical eye and plan to do his necessary spring housecleaning. Accumulated spare parts and old fittings should be checked over and stored in suitable places. Any obsolescent material should be discarded. Steelwork, crane and walls may need paint and the floor may need a new application of dressing, if such is used, to keep down dust and to improve appearance. Broken and torn insulation on steam pipes or breechings should be patched up. Valves may need repacking. The surroundings of the plant can be tidied up and made more pleasing. A clean attractive plant arouses a greater urge in the minds of its operators to get better results.

Plans also can be made for the annual overhaul and inspection of plant equipment so that this will be in fit condition to carry fall loads. If new apparatus is to be bought this year, now is the time to start inquiries for midsummer delivery.

The Twenty per Cent Fetish Should Be Destroyed

JUST why have many business men, and engineers too, for that matter, taken the position that any new power-plant equipment must pay for itself in five years? Some are so radical as to want the profits to pay for the machine within three years. When has business as a whole ever made a gross of twenty per cent on its investment? Yet this is, in effect, what is obtained when a machine must pay itself out in five years. After all, this is not the way to figure the problem.

In any industry where advances are rapid, good judgment demands that a piece of equipment be paid for out of decreased costs before it becomes out of date. In fact, in the automotive industry a machine usually is old fashioned within two years, and this must be considered.

On the other hand, advances in power-plant equipment are not so rapid, and engines or boilers installed ten years ago are not necessarily out of date. It is safe to predict that many machines installed today will be giving economical service twenty years from now. Then why not take this into account?

Of course no business man is going to install a machine that will not pay a profit, but many are passing up propositions far better than five per cent bonds merely because of an adherence to a business principle both ill-founded and unprofitable.

Low Pay for the Engineer—Why?

LIGHT shines from a charming essay on "The Country Lawyer," by F. Lyman Windolph, in the April issue of the *Atlantic Monthly*. In closing, the author remarks that " the engineer, . . . the scientist, and a hundred others have, indeed, fed as well upon learning as the physician, the lawyer and the divine, but the old magic authority of learning—the old faith that education necessarily, or at least presumably, brings wisdom and goodness to its possessor—is . . . dead, . . . And yet, because the great experiences of men are still births and deaths, their great concerns health, liberty, and happiness, and their great aim salvation, the three learned professions remain, as obviously as ever, in a place apart. After all, learning was never more than one of their incidental distinctions. Now, as always, their true distinction lies less in their achievements than in their purposes and in the resulting intimacy and beauty of those human relationships which occur so frequently in the life of the country lawyer. Whether or not his training has made him learned, his experience ought to make him wise and good."

Perhaps Mr. Windolph has touched the point. The engineer does not deal with the basic vitals of life, hence his services are subject to the cold balance of supply and demand. He has market value. What is the market value of the lawyer who will defend you against malice? Or of the surgeon who will relieve your suffering or save a life beloved? Or of the priest who points the higher way of life?

One confides in his lawyer. One loves his physician. One almost worships his priest. But the engineer? Just another workman, high-grade it may be, but of the stuff of the mind rather than the heart.

Can the engineering profession rise above this level?

Performance Versus Special Designs

THE demand for special equipment to meet present advances in operating practice often imposes a difficult task upon the manufacturer in the fixing of performance guarantees. Unlike standard equipment, whose performance is well known through shop tests and service records, special designs must depend largely upon calculations tempered by the designer's experience. In such cases it sometimes becomes necessary to employ a greater tolerance in figuring probable performance; and in this the conservative manufacturer may be penalized by comparison with his more daring competitor. Right here, the customer should give weight to the relative reputations of the bidders in meeting guarantees.

A still harder task is encountered where factors not within control of the manufacturer, nor of the customer, produce operating conditions different from those specified. Such cases often involve expensive servicing which the manufacturer is expected to bear. If he refuses, he jeopardizes his good will and is unlikely to receive a repeat order. On the other hand, the customer may not be without some justification in insisting that this be done.

Here is just another problem upon which manufacturer and purchaser should get together. There is need for them to develop a solution on an equitable basis. They have a common interest and any advantage taken by one over the other reflects, in the final analysis, on both.

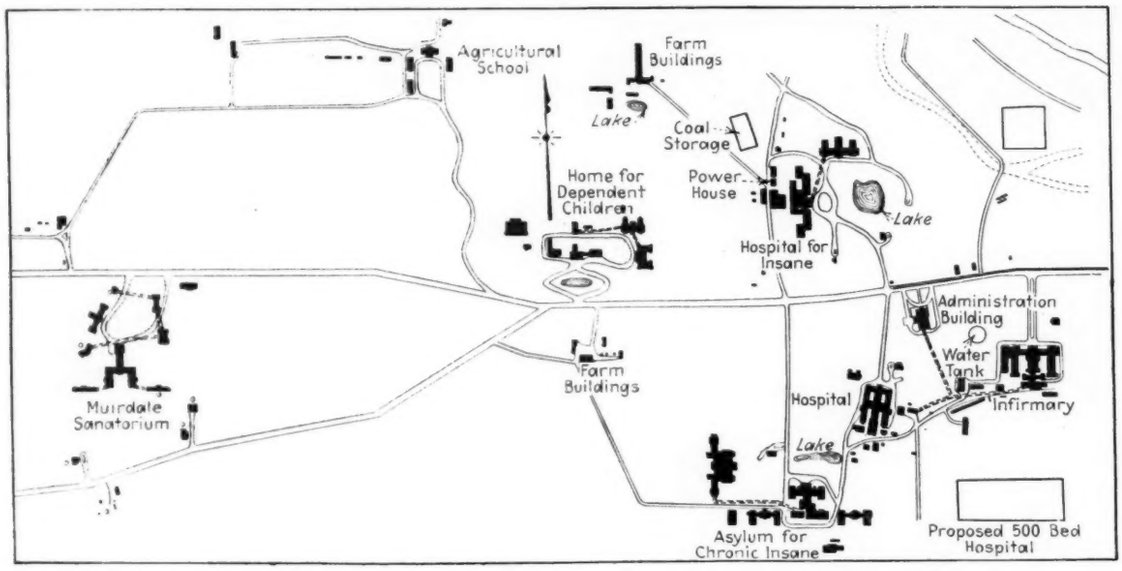


Fig. 1—Ground plan of Milwaukee County Institutions

At Milwaukee County Institutions

Two Plants Do Work of Six

saving $61,000 per year

By L. H. Stark

MILWAUKEE COUNTY has made the progressive step of grouping the various institutions used for the care and treatment of dependent people within an area of one square mile, so that the advantages of group arrangement and administration are made use of. The history of the growth of the institutions dates back to 1852, when the first tract of land was purchased by the county board of supervisors and provision made for a poor farm. Now located on this original tract are the Infirmary, erected in 1907; County Hospital, in 1880; Asylum for the Insane, in 1888; Administration Building, in 1921; and County Hospital, in 1925. Additional land was purchased for a Hospital for the Insane, erected in 1880; Home for Dependent Children, in 1882; Muirdale Tuberculosis Sanatorium, in 1915; Milwaukee School of Agriculture, in 1912. Later, in a purchase made from the City of Milwaukee, the Blue Mound Sanatorium was acquired.

The institutions have a population of approximately 5,000, including 850 employees. The net operating costs amount to about $1,250,000 per year, and the total valuation of all properties, including land, buildings and supplies, is around $10,000,000.

Provided the future expansion of the building program could have been anticipated, a glance at the ground plan of the entire group of buildings, Fig. 1, would suggest that the ideal location for a power plant would have been on some centrally located portion of the tract, but owing to the fact that the buildings have been erected over a period of 75 years and only as necessity has required them, the county finally was confronted with a condition in which were to be found six individual power plants on eleven hundred acres of land, provision made for the erection of several new units, and prospects for additional units in the near future. The building of a central power plant and abandonment of the six isolated plants was discussed by the county board in 1913, but as the project would have cost over $1,500,000, the idea was indefinitely postponed.

After giving existing conditions careful consideration, it was decided finally to select the two most modern and fortunately best-located plants to supply the services required at present and in the future by all the institutions. These plants are at Muirdale on the west, and the infirmary on the east side of the property, a distance of about a mile separating them.

In many respects the infirmary plant was not modern, but the fact that it is near to buildings recently erected, as well as to those to be built, seemed to determine its location permanently. Other factors confirming the selection

of this site were the location here of the pumps furnishing the water supply for all institutions and the necessity of replacing the boilers, which were from twelve to twenty years old, with larger ones to handle the additional load created by the building of new units.

It was decided that ordinarily the infirmary plant should furnish light, heat and power to the buildings shown in Fig. 1 at the eastern end of the property, while the power plant at Muirdale was to furnish the same kind of service to the sanatorium there, the Agricultural School, the Home for Dependent Children, and any additional units that might be added to this group. The Blue Mound Sanatorium is furnished with electrical energy from the infirmary plant, but as this unit is some distance from either power plant, it was decided to retain the heating plant there. The rebuilt power plant at the infirmary is shown in Fig. 2. The building on the left contained the original engine and boiler rooms, while the new building on the right, between the chimneys, houses the new boiler equipment. In 1925 two 5,000 sq.ft. Casey-Hedges five-drum four-pass water-tube boilers for 200 lb. working pressure, with Detroit mechanical feed

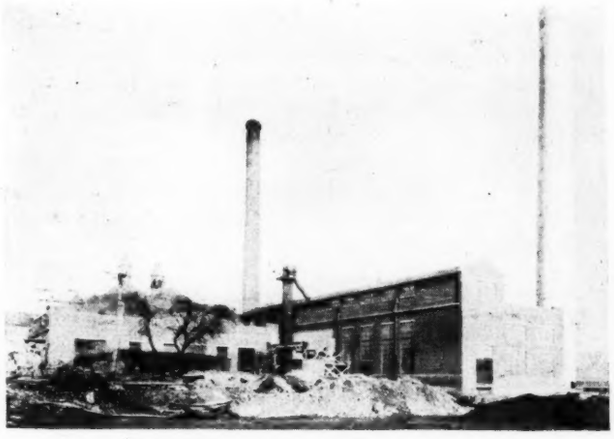


Fig. 2—Rebuilt plant at infirmary

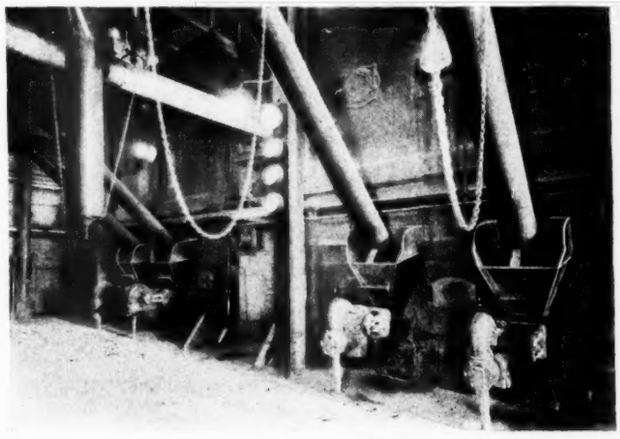


Fig. 3—New boiler units of infirmary plant

stokers, were installed in the new boiler room, as shown in Fig. 3. In 1926 three similar units were added and foundations for a sixth unit provided for an aggregate of 30,000 sq.ft. in steam making surface.

Draft Equipment Provided

Draft is provided by two concrete stacks, one 157 ft. high and 6 ft. in diameter at the top, and the other 164 ft. and 9 ft., respectively. Forced draft is provided by two Clarage engine-driven fans, with motors installed on the engine foundation to furnish secondary power to the fans in an emergency. Ashes are removed by an American steam-jet ash conveyor.

Feed water is taken from an open heater, with a capacity of 60,000 lb. per hour, and delivered to the boilers by double-acting boiler-feed pumps. Centrifugal feed pumps will be installed in the future.

No change in the boiler plant at Muirdale has been considered, as the four 1,500-sq.ft. return-tubular boilers are still in good operating condition. There is room, however, for two 3,500-sq.ft. water-tube boilers that eventually will be installed. At the Blue Mound Sanatorium two 850-sq.ft. low-pressure boilers will be retained, as previously mentioned.

Within the six old plants the original generating equipment consisted of quite an assortment of mixed current and voltage machines such as 110-volt direct current, 110-220-volt direct current, and 440-volt two-phase alternating current. To remedy this condition, it was decided to standardize on 220-volt three-phase 60-cycle alternating current for all secondary energy, and 2,300 volts for the primary current to be generated in both plants. In harmony with this plan a 2,300-volt line extends from the infirmary plant to supply all buildings north of the Watertown Road and terminating at Muirdale (see Fig. 1), while a similar line extends from Muirdale south of the same road to furnish current to all buildings in this district and finally tying in at the infirmary. In case either plant is disabled, service may be supplied to the entire group by the other, an important consideration where continuity of service is the prime requisite.

Changes in Electrical Equipment

A 200-kw. 110-volt direct-current generator was moved from the Hospital for the Insane to the infirmary plant. A 2,300-volt alternator replaced the 110-volt generator when the move was made. Two 200-kva. 2,300 to 440-volt transformers were used temporarily to furnish energy to the old system until such a time as the motors and wiring could be changed over to three-phase 220-volt. The 400-kw. generator and engine were installed new in 1925, and the 500-kw. unit has been erected recently. In the engine room at Muirdale, shown in Fig. 4, the Corliss engine in the foreground drove a 110-220-volt three-wire direct-current generator which has been replaced by a 200-kva. 2,300-volt three-phase 60-cycle alternator. The engine in the background was direct connected to a 160-kw. 110-220-volt generator now replaced by a 250-kva. alternator.

Excitation current is provided for the two alternators by two 30-kw. direct-current generators, one driven by motor and the other by a steam turbine. The switchboard is of the modern dead front type, with the remote-control oil switches and transformers placed in a fireproof compartment back of it. The changes made in converting the plant from direct to alternating current were accomplished without any interruption in service.

Wherever an alternating-current machine has been substituted for one generating direct current, some changes have been made in the foundations, but the engines have not been disturbed from the original foundations.

At the Hospital for the Insane two 2,300-volt syn-

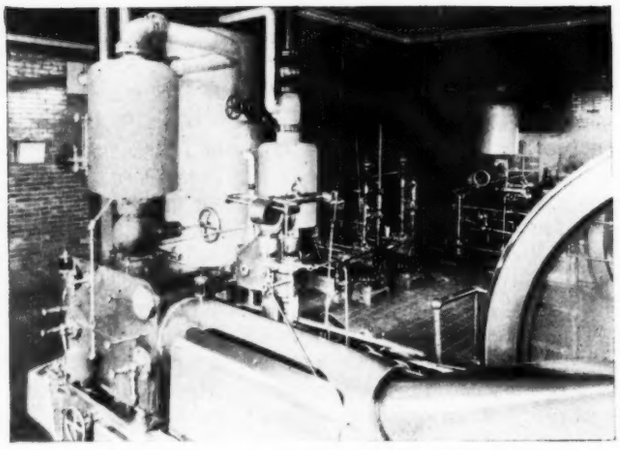


Fig. 4—Engine room at Muirdale plant

chronous motors direct connected to two 50-kw. 110-volt generators were installed to supply current to the old system from the new high-tension lines from the infirmary plant. Likewise, all the other institutions that have or will abandon their power plants will be supplied with high-tension current from either the infirmary or the Muirdale plant.

As the motors in this class of buildings do not run into large sizes, the expense of changing them to conform to the new secondary voltage will not be large. All the two-phase motors have been rewound or reconnected for three-phase 60-cycle 220-volt service.

Electricity is used for cooking and baking in some of the institutions. To help iron out the load factor curve, the baking is done at night when the electric load is at the minimum. The power factor runs from 90 to 94 per cent. This is unusually high, but is accounted for by the greater part of the total load being in lighting, cooking, heating and synchronous motors. There are 273 motors in all institutions ranging from $\frac{1}{8}$ to 70 hp. in size. The total electrical consumption approximates 2,225,000 kw.-hr. per year.

Coal and Ash Handling

Coal formerly was delivered by rail to three of the plants and by truck to the others. In conformity with the new program a site convenient to both operating plants was selected for a coal storage yard having a capacity of 20,000 tons. The coal-handling equipment, consisting of a Chain Belt traveling crane and loading hopper, crusher and storage hopper, is shown in Fig. 5. Coal is unloaded by the clamshell bucket at the rate of eight cars per day and deposited on the storage pile. It may be taken from the storage pile or car direct and dumped into the loading hopper, which travels with the crane, and thence to trucks for conveying it to the power plants. The crane covers a distance of 500 ft., the type of drive being shown in Fig. 6. The loading hopper is shown in Fig. 7.

Should it be necessary or desirable to use lump or mine-run coal instead of screenings, the fuel may be prepared for the stoker by running it through the crusher, which has a capacity of 30 tons per hour, and thence to the 60-ton storage hopper shown in Fig. 8. The crusher hopper is loaded from the storage pile by means of the traveling crane.

Coal delivered to the plant at Muirdale is unloaded in front of the boilers and fired by hand. Eventually, as new boilers are needed, coal handling and storage equipment will be installed. Coal brought to the infirmary plant by truck is dumped into a pit below the ground level and is raised by the bucket elevator shown in Fig. 2 to be transferred through the roof to a screw conveyor distributing to the 200-ton overhead storage bunker.

Heating

In the latitude in which the institutions are located heating must be provided from eight to nine months of the year. In all buildings approximately 19,500,000 cu.ft. of space is heated by 156,000 sq.ft. of direct and 104,000 sq.ft. of indirect radiation. Buildings grouped within a short distance from the power plants are heated with exhaust steam from the engines at from 1 to 5 lb. pressure, supplemented with live steam reduced from boiler pressure when necessary. All other buildings are supplied with live steam at 150 lb. pressure through underground pipe lines, the pressure being reduced at the point of entering the building.

All condensation will be returned to the open feedwater heaters in the power plants by automatic centrifugal vacuum pumps. Muirdale is heated by a vacuum system using exhaust steam at $1\frac{1}{2}$ lb. pressure and from 12 to 16 in. of vacuum. All cooking at present is done with exhaust steam. Under these conditions, rooms 1,700 ft. from the engine room are easily heated.

Formerly, heating of buildings at the Infirmary and the Hospital for the Chronic Insane was done by a single-pipe system. Through an ingenious method of draining all risers and mains with vacuum traps operated in conjunction with electrically driven vacuum pumps and receivers, the system was converted to a one-pipe vacuum system without the changing of a single radiator connection.

Refrigeration

Each group of buildings is provided with a refrigerating equipment to furnish artificial ice and low temperatures where needed. There are 11 machines with an aggregate capacity of 85 tons of refrigeration. With one exception they are Vilter motor-driven ammonia compressors with forced brine circulation. In the engine room at Muirdale is a 15-ton machine that lowers the temperature in 15 boxes located on different floors of the institution. Brine is circulated through the boxes by a motor-driven direct-connected two-stage centrifugal pump operating against a 75-lb. head. There are two 10-ton machines in the administration building, where all perishable food supplies are received and stored before being delivered to the various institutions.

Water Supply

Water used in all institutions in 24 hours approximates 1,250,000 gal. It is obtained from the city and is delivered through a 16-in. main to an underground cistern near the infirmary plant holding 1,700,000 gal. An additional 16-in. main will be laid in the near future to provide for expansion and the continuance of uninterrupted service.

From the cistern the water is taken by two 2,000,000-gal. pumps, one a 14x28x$9\frac{1}{2}$x24-in. horizontal double-acting compound that may be run condensing should there be a surplus of exhaust steam, and the other an 18x20x$13\frac{1}{2}$x24-in. pump of the same type running non-condensing. The water is delivered to a 100,000-gal. tank 150 ft. above ground and thence to the various buildings by gravity. A 1,000-g.p.m. centrifugal motor-driven pump will be installed to assist in furnishing water to the general supply system.

All buildings are protected from fire by automatic sprinkler systems supplied from this system. There will be installed an Underwriters motor-driven centrifugal fire pump that may be operated from current generated in either plant. As an additional protection from fire the institutions maintain a fire department.

Savings effected by the changes made cannot be determined at present, as sufficient time has not elapsed since some of the equipment has gone into service to realize definitely what the ultimate results will be, and some of the new equipment has not as yet seen duty. At the time of writing the infirmary plant was supplying electrical energy to five institutions, but in three of them the original heating plants were being retained. Under these conditions 35,000 tons of coal was burned in 1925, and in 1926 the requirement was 30,000 tons of coal while producing more energy than was obtained the previous year. In addition to a saving in fuel of 5,000 tons, or 13.5 tons per day, the new hospital building was supplied with heat valued at $3,000 and a total of 388,572 kw.-hr. of electrical energy was supplied, which, at 2c. per kw.-hr., amounts to $7,771.

Delivered to the boilers, the coal cost was $5 a ton, so that the saving of 5,000 tons amounted to $25,000. During 1927 the three heating plants mentioned were abandoned, with a saving in labor of $25,400 a year and an additional saving in fuel of some magnitude is anticipated. Even without this anticipated saving in coal a total saving of $61,170 a year is assured. The estimated cost of all improvements is $600,000. The expenditures to date and those to be made to complete the undertaking indicate that this figure is conservative. It is evident that the savings already effected guarantee a gratifying return on the investment, with promise of improvement.

Boilers originally installed in the six plants were 24 in number with a total of 38,700 sq.ft. of heating surface. Under the new plan 11 boilers with 32,700 sq.ft. of surface will carry the load increased by the addition of two 500-bed hospitals.

At the present writing William L. Coffey is manager, and Joseph Fischer, chief engineer, of the Milwaukee County Institutions. To these men the writer is indebted for the information and statistics contained in this article. Mr. Fischer has had charge of the layout, recommendations for purchase, and installation of all equipment that has entered into the redesign of the power and heating systems.

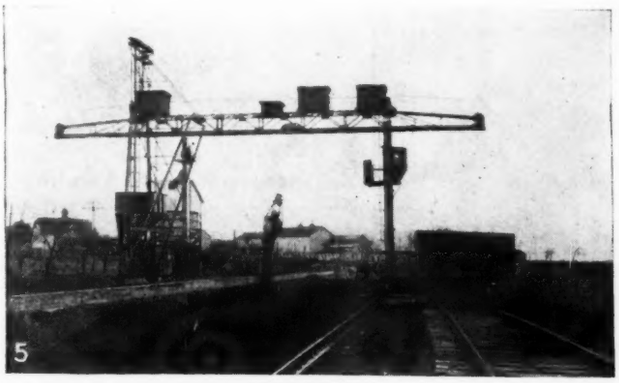
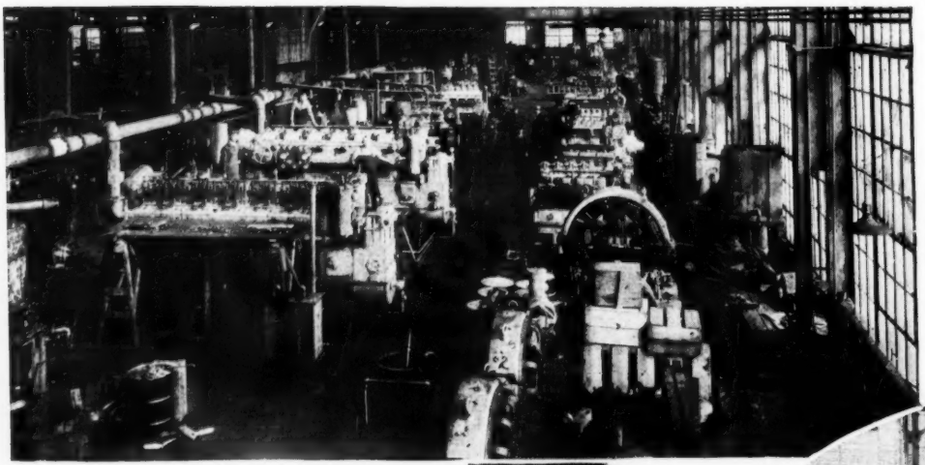


Fig. 5—Coal-handling equipment at storage yard. Fig. 6—Type of drive used on crane. Fig. 7—Loading hopper mounted on crane uprights. Fig. 8—Crusher and storage hoppers.

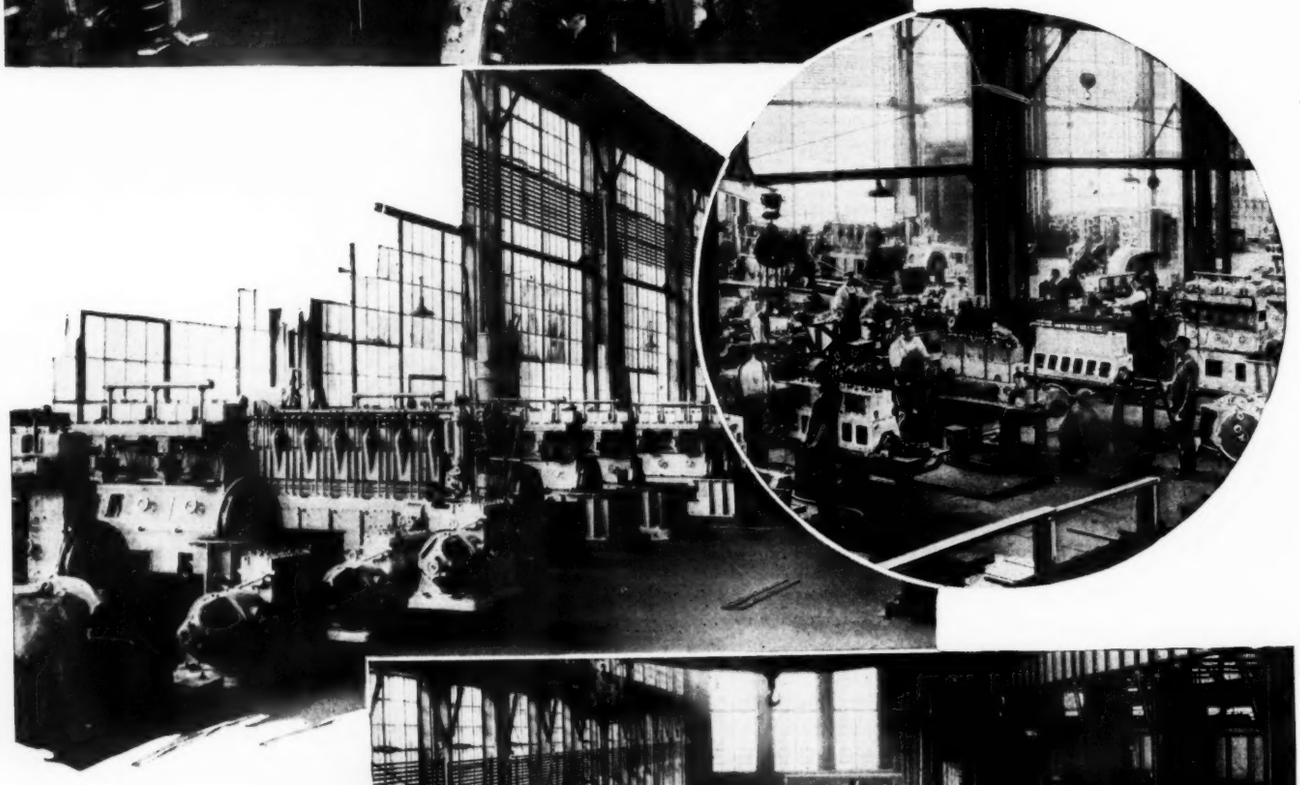
MODERN POWER SERVICE SUPPLY

WHEN a manufacturer of drugs, with nearly 3,000 different products in regular production, applies Ford methods successfully, it's a sure indication of engineering leadership. And the same skill is shown by this plant, Eli Lilly & Company, Indianapolis, Ind., in supplying power services for this production. The story will be told in POWER *on May 22.*

Erecting Diesel Engines



Unemployment and lack of orders are not problems in the Diesel engine industry



Photographs were taken through the courtesy of the Winton Engine Company and show steps in erection of Diesel and gas engines

FACTS ON . . .

Leather Belting

By John Cassiday

MANY ENGINEERS seldom give a thought to the subject of belting, feeling that direct-connected motor drive is the modern method of transmission. In spite of this, investigation by the United States Census Bureau reveals that over one-half of the power developed in industrial plants is obtained from generating units by other than motor drive. This means that millions of horsepower are delivered by belts from steam or oil engines or from waterwheels. In addition, of the power obtained from outside sources, a large percentage is transmitted by belting at the factory.

The multiplication of factories has increased the use of the smaller sizes of belting, for each motor- or shaft-driven punch, lathe, loom, etc., requires a belt. It is, of course, true that many machines are gear driven, but in the main belting is still the method by which power is transmitted from the power unit to the manufacturing equipment. In certain processes, such as wiredrawing and machine manufacturing, leather belting is used almost exclusively. One firm, for example, spends over $800,000 yearly on belting. This is not because some official has a predilection for belts over gears or direct-connected drive, but is due solely to the fact that for duties when heavy, sudden loads are thrown upon the driven machines, the blow is better absorbed by a belt than by gears, so that the driving unit escapes injury.

Group drive from a single motor is still a general practice. This entails the use of more belting, but many plants have found that the investment in spare belting, as compared to investment in spare motors when individual motors are used, is sufficiently less to justify the group system. This advantage is augmented by the better efficiency of the larger motor when the group of machines work on a continuous process. It is admitted that individual drive makes for an attractive factory interior, but, after all, convenience and efficiency, rather than an artistic background, are the factors to be heeded in production. In spite of this wide application of belting the same procedure as to choice of the belt for a given drive, treatment and adjustment which was followed twenty years ago, is still almost universally observed. If belting has decreased in esteem, its fall is due to its neglect at the hands of the plant engineer.

In the first place engineers should appreciate the fact that while a belt is a belt, any old belt is not good enough

Are you neglecting your belting problems?

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Do you know what kind of belt to specify?

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How much filling should a belt be given?

•

The answers will be found in this article

Fig. 1—A maindrive belt from the engine in a factory plant

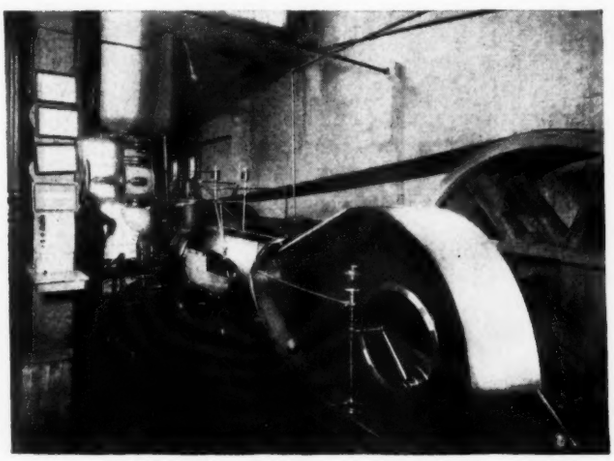
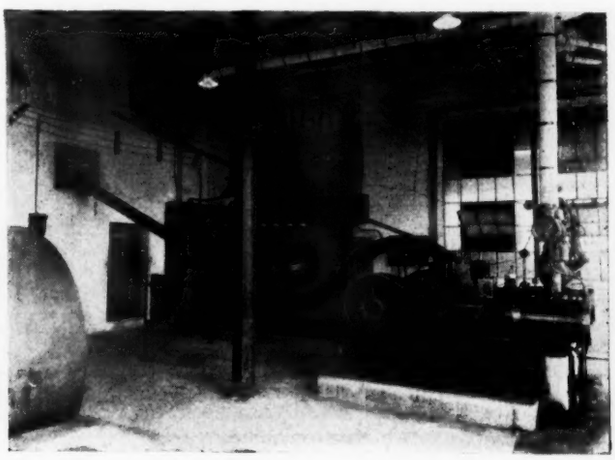


Fig. 2—Paper beaters are generally belt driven from a steam engine



for all drives. Each job requires study before the proper belt can be chosen. A drive in a rock quarry demands an entirely different belt from one in a chemical factory. It is the failure to appreciate the variation in conditions that has brought the belt into disrepute with many engineers. It cannot be stated too emphatically that when the proper belt is chosen and correctly applied, operating troubles disappear and repairs are reduced to a minimum.

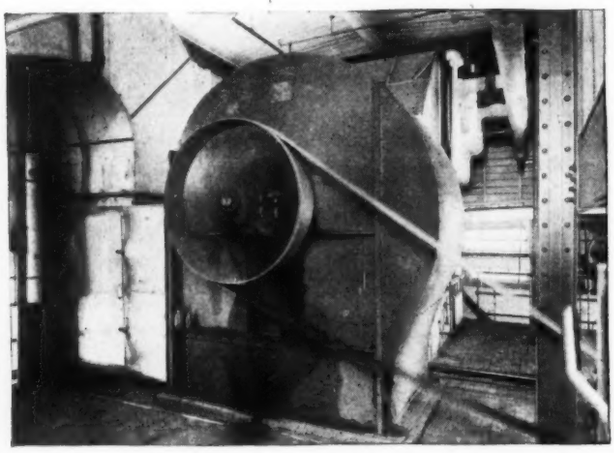


Fig. 3—By using a high-speed motor belted to a slow-speed fan, the electric power costs are reduced

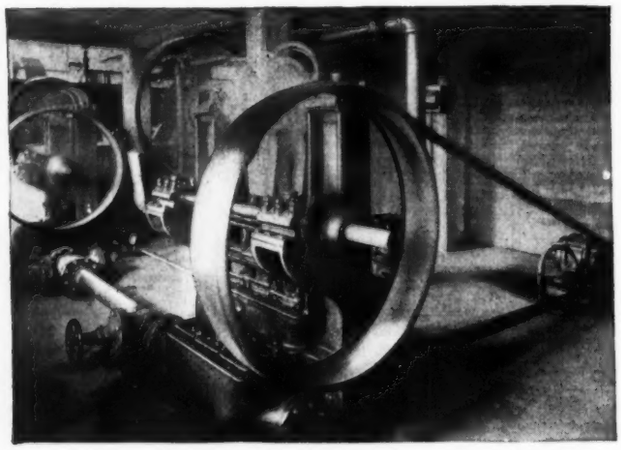


Fig. 4—In pump drive the belt is a safeguard against overloading the motor

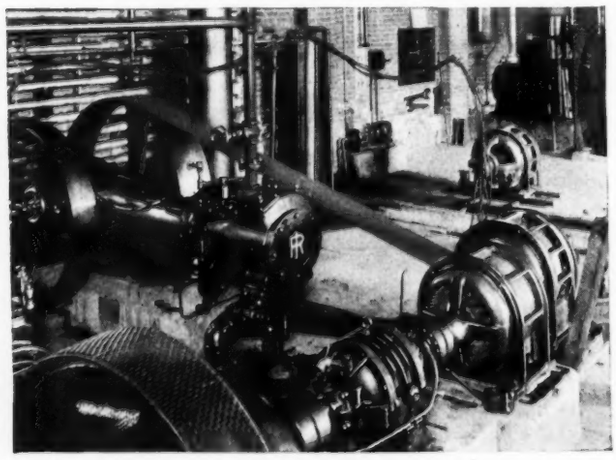


Fig. 5—Belted air compressors in ice plants work out advantageously

In a short article it is impossible to discuss the choice and application of belting in a complete manner. Consequently, only a few high points will be covered here, and subsequent articles will be devoted to a number of the specific factors. Only leather belting will be mentioned.

As all know, leather belts are obtained from the tanned hides of cattle. To others than a cattle or hide man, a hide may seem but a hide. Still there is a wide difference in hides as to belt-making qualities.

In the tanning of the hide all the natural animal oils are removed by the acid action. It is necessary, then, to replace this oil by the application of either fish or lard oil. Vegetable oil is satisfactory, but in no case should a mineral oil treatment be permitted, for this oil will rot the leather. Neither should the engineer apply mineral oil to a belt that has become dried in service. The best method of oiling a belt is to use melted lard oil applied with a brush. The amount of oil or grease lard to fill the leather during manufacture should not be less than 8 per cent by weight.

Many have the belief that the best belt is one made from the center of the back of the hide. In fact, the backbone of an animal causes the hide above it to be of inferior quality. The best belt is made from the hide bordering on the backbone strip. Still, so insistent are some engineers on seeing the darker line on the belt, denoting the backbone region, that unscrupulous manufacturers at times discolor the belt center. This can be detected by the way the fibers interlace.

In many hides, especially those from old bulls, the portion toward the shoulders is much thicker than the remainder, and it is the policy of some belt manufacturers to run the strip through a shaving machine in order to reduce it to a uniform thickness. This removes a part of the flesh side when the fibers are locked together in a dense mass, and this shaving process weakens the structure. In buying a single leather belt, the engineer can detect this shaving process by the difference in the appearance of the flesh side of the hide.

It might be well to state at this point that no leather belt ever wore out if kept in good condition. In fact, a 14-in. double leather belt 150 years old was recently tested and found in good shape.

In making joints in laps, many insist on a ten-inch lap, even though a lap of four inches will have a joint strength greater than the strength of the solid leather. In a long belt this six-inch saving at each joint means a considerable decrease in the belt cost.

Leather belting is usually classified as single leather, oak-tanned; light double leather, oak-tanned; medium and heavy double, oak-tanned. These classes should be added to others made up of belts tanned by special process.

The single oak-tanned belt is adapted for small process such as light machine tools. It has the advantage of operating over small-diameter pulleys without trouble. A duty of three to four horsepower is about the maximum load for such belts.

The light double belt is suitable for loads up to twenty horsepower at moderate speeds.

Ordinary main and jackshaft drives should be made of medium and heavy leather belting. Pulleys should not be less than ten inches in diameter. This belting will give excellent service as long as it is not in contact with steam or acid fumes.

In wet localities or in shops where there are acid or steam fumes, a special tanned belt is the only suitable one.

Process Steam for Paper Mill

Produced by Hog Fuel and Oil

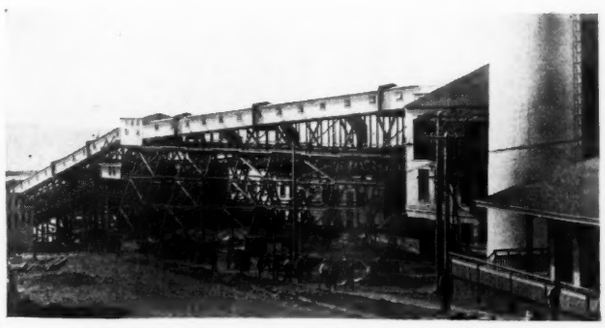
By P. Sandwell

Modern twelve-boiler plant supplies daily 5,000,000 lb. of process steam to paper mill. All necessary power is generated hydro-electrically. Hog fuel, burned in Dutch ovens on either flat or inclined grates, supplies 30 per cent of the steam and the rest is supplied by fuel oil, the burners being mounted on the rear wall of a common combustion chamber.

THERE has been completed recently at the newsprint plant of the Powell River Company, Limited, Powell River, B. C., a steam plant embodying a number of late features. At this plant all necessary power is generated hydro-electrically and the steam plant is installed to supply steam for purely process purposes, such as for digester use and drying, although there are installed two steam turbine-generators having an aggregate capacity of 2,000 kw., for use in emergencies or in case of a prolonged drought. The paper mills have a daily capacity of 475 tons, and the total production of the steam plant averages about five million pounds a day of 24 hours.

Construction of the new steam plant was begun in 1923, when it became necessary to retire some of the return-tubular boilers installed when the mill was originally built in 1913. At the time of remodeling, the paper mill had a capacity of about 250 tons a day, but it was expected that an extension would be made shortly and the steam plant therefore was designed so as to be expanded easily to meet later requirements. The plant now houses six batteries, each consisting of two 4,900-sq.ft. water-tube boilers, and can be extended to accommodate two more batteries of similar dimensions, while there is room in the present building for the installation of a 5,600-sq.ft. boiler now in operation in the old plant.

Preparation of wood for conversion to paper results in the production of a certain amount of wood waste suitable for fuel. The total quantity produced, however, is sufficient only to provide some 30 per cent of the process steam required and the remainder, in this plant, always has been made up by the use of oil fuel. When the new plant was planned, consideration was given to the use of alternative fuels, but the fact that the plant already was equipped with storage facilities and can be reached by the largest tankers, so that the importation of oil is simple, influenced the decision to continue to use this fuel. Provision was made, however, so that in case of changes in fuel values the plant could, without unreasonable expense be converted for the use of coal, either with mechanical stokers or in the pulverized form. Further, in the design of the equipment for handling hog fuel from the sawmill to the boiler house, provision was made for the importation of this fuel should it later be found desirable.

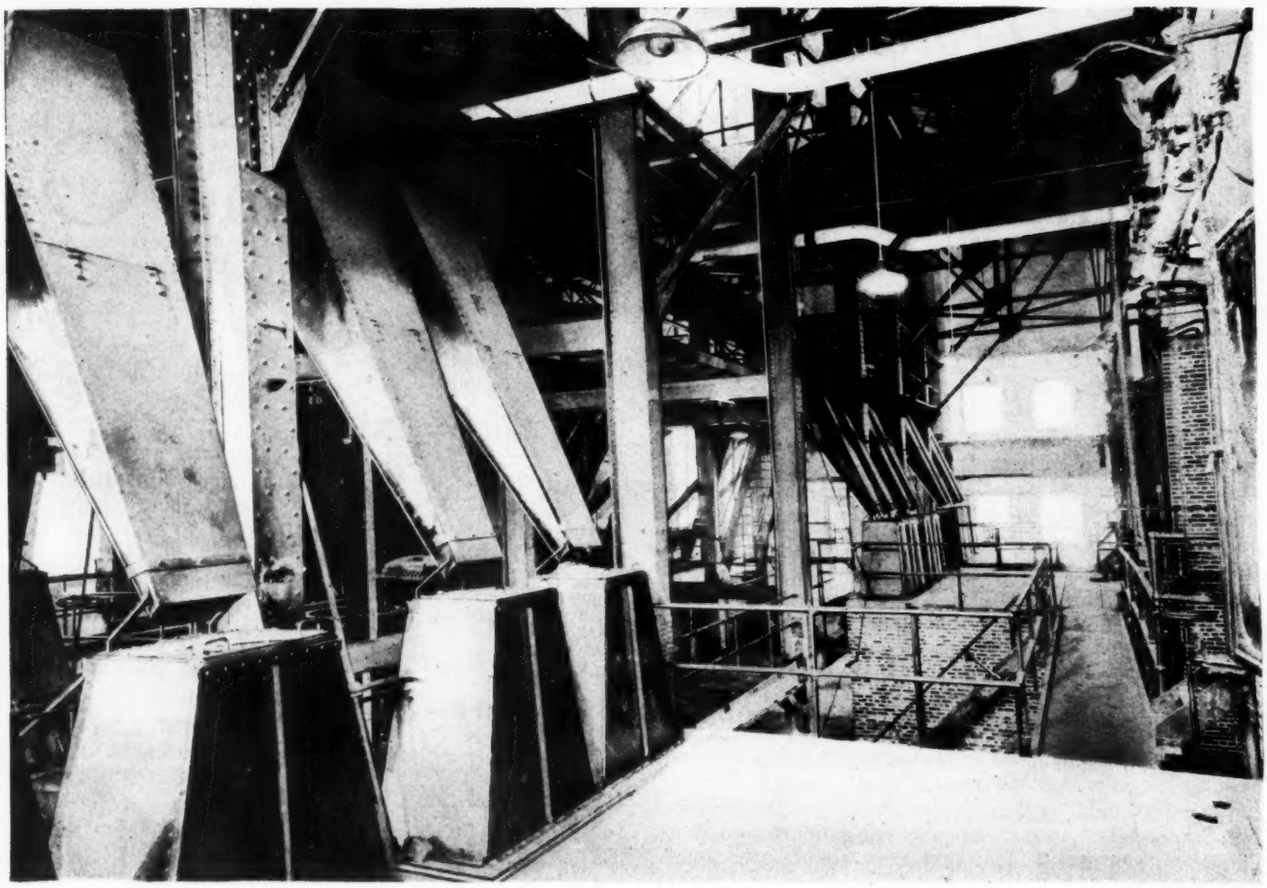


Hog fuel handling system and storage

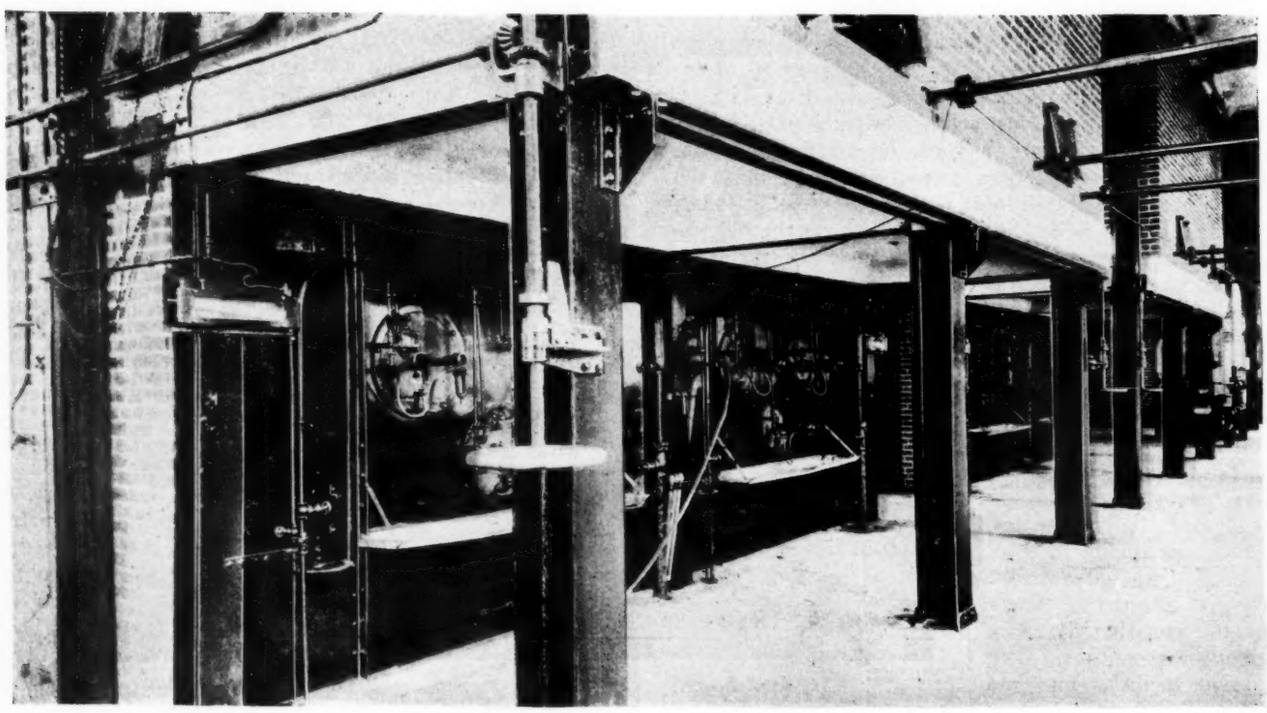
The boiler house itself is a steel-framed building with concrete basement and firing floor, concrete walls and steep pitched corrugated iron roof. The boilers are mounted in pairs and each boiler is equipped with a Dutch oven for the consumption of wood fuel and with oil burners. In operation every endeavor is made to keep individual boilers operating continuously on wood or on oil, but on occasion the wood fuel is of such poor quality that some oil has to be added to assist combustion. So long as the mixture of fuel can be avoided, the keeping of records of individual boiler performance is comparatively easy, and in this way plant operation can be kept up to the mark.

Each boiler is equipped with a steam-flow meter and CO_2 and flue-gas temperature recorders. The flue-gas temperatures are recorded on the flow-meter charts. As a further check on boiler steam production, totalizing meters are installed, one on the east side and one on the west side of the plant, each totalizing the production of six boilers, and in addition a Venturi recording meter is used for the measurement of feed water to the boilers.

All oil burners are of the mechanical atomizing type, three burners being fitted to each boiler in the rear wall of the combustion chamber. Oil is handled at an average pressure of about 200 lb. and at a temperature of about

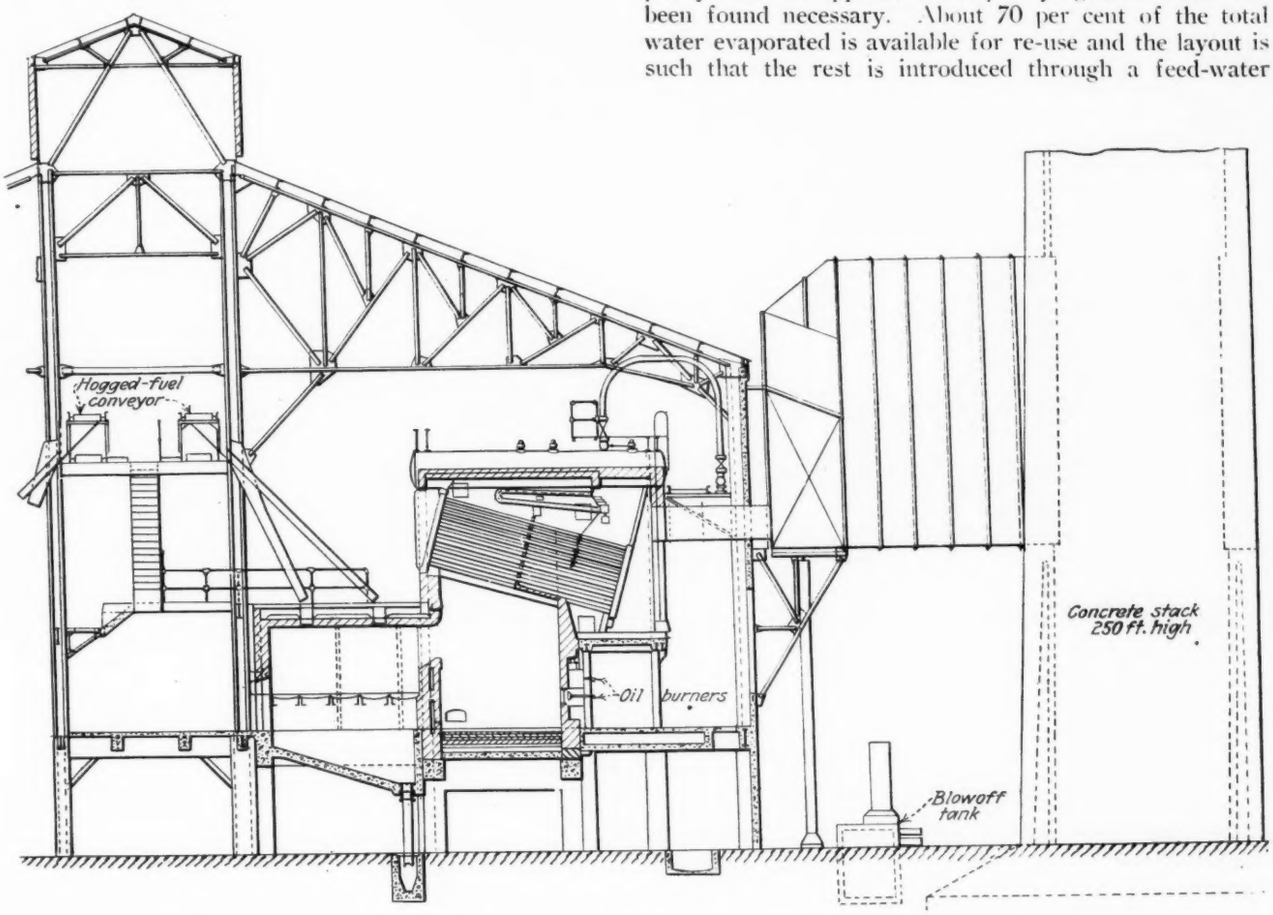


Spouts (above) feed hog fuel to Dutch ovens, while oil burners (below) are fitted to rear furnace walls



175 deg. F. The side and center walls and the floors of the oil burning furnaces, which also constitute the combustion chambers when burning hog fuel, are air cooled and act as air preheaters.

Dutch ovens of both flat-grate and inclined-grate types were installed. All ovens are equipped with suspended arches, and the firing deck above the ovens is of pre-cast concrete blocks. These blocks have been found much easier to work on than the more usual checkered plate steel deck, being cooler and providing a better grip for the firemen's feet. All the Dutch ovens are fed by chutes from overhead conveyors and are equipped with hoppered ashpits, from which the ashes are sluiced into a flume carrying them into the mill-waste flume.



Half cross-section through boiler room showing Dutch oven for the burning of hog fuel and the oil burners in the rear furnace wall

The plant is equipped with two concrete stacks 250 ft. tall by 14 ft. inside diameter, connections to which are made by means of steel breechings suspended on the outside of the boiler house walls. Stack arrangements are so made that, should it be found desirable later on to use economizers, the installation can be made with the least possible alteration to the existing system.

Fuel is automatically collected in the sawmill and barker mill by conveyors, which in each case deliver all the coarser material to hogs for reduction to hog fuel size. The fuel is then carried by a system of outside conveyors to the boiler feed conveyors, which are so arranged that the boilers are fed from the upper run, any surplus fuel being carried back on the lower run and delivered to the storage conveyor, which distributes the surplus fuel to the storage piles. Beneath the storage piles are arranged belt conveyors that reclaim the fuel as required and deliver it to an elevator that in turn transfers it to the upper flight of the boiler feed conveyor. In this way a constant supply of fuel can be maintained, the storage pile being used to supply any deficiencies or absorb any surplus of fuel as delivered from the sawmill. All the conveyors are of ample capacity to deal with total steam plant requirements should it later be decided to import hog fuel.

The Powell River Company is fortunate in having available a supply of boiler feed water of exceptional purity, and no apparatus for purifying feed water has been found necessary. About 70 per cent of the total water evaporated is available for re-use and the layout is such that the rest is introduced through a feed-water heater located in the sawmill and using the heat available from the steam exhausted by the band mill and edger feed engines and log deck machinery. This water is delivered to a hotwell in the machine-room basement, which receives the condensate from the two paper machines located in this building as well as from all the heating coils and other necessary steam-using appliances.

In the old part of the plant there is a hotwell arranged for the collection of condensate from the four smaller paper machines, and water from both of these wells is pumped back to a feed-water heater located in the boiler house. Under normal operating conditions feed water is pumped from the heater by an electrically driven three-stage centrifugal pump having a capacity of 625 imperial gallons (750 U. S. gallons) per minute at 415-ft. head. As a stand-by, there is installed a steam-turbine-driven centrifugal pump of the same capacity. When this tur-

bine is operating, the exhaust is condensed in the feed-water heater. Each of these pumps is equipped with a pump governor actuated by boiler steam pressure in such a way as to maintain a constant predetermined excess of water pressure over steam pressure. In addition, each boiler is equipped with an individual feed-water regulator.

The design and construction of the complete plant was carried out under the direction of the engineering department of the Powell River Company by Chas. C. Moore & Company, engineers, of San Francisco.

A Type of Fuel-Valve Packing That Lasts

By A. B. Newell

LEAKING fuel-valve packing is at best an annoyance and at worst a constant source of trouble and a nuisance. We may disregard the loss of compressed air and the power it takes to produce it, for these seldom amount to enough to affect the power output of the plant seriously. But some fuel valves are designed so that fuel will also leak out around the spindle, and when this occurs it is impossible to keep the cylinder heads and the outside of the engine clean. Conditions such as this are not inevitable, yet we find some plants where such appears to be the opinion of the operators.

The general elimination of fuel-pump packing in favor of plungers that fit so closely as to make leakage negligible might lead us to believe that some similar method could be employed with the fuel-valve spindles. However, differences of temperature that occur in the vicinity of the fuel valve are not characteristic of the fuel pump, which is well removed from the heat of combustion, and the constant passage of fuel tends to maintain a uniform temperature and provide ample and efficient lubrication, a characteristic lacking in compressed air.

Various forms of fuel-valve packing have been tried, and now the method most commonly employed consists of some form of commercial metallic packing or an engineer's own favorite formula of shredded lead, graphite, antimony, asbestos and cylinder oil or cup grease, mixed in various proportions and tamped into the packing box around the fuel-valve spindle.

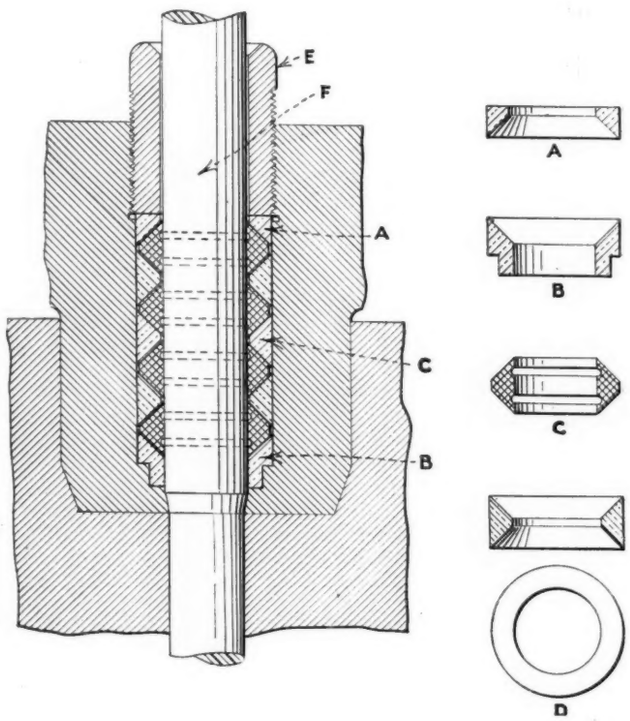
Some excellent results are obtained in this way, and when such is the case there is surely no need of making a change. I have tried a number of them and from time to time would feel quite sure that my own little system was superior to all others.

Eventually, I adopted the method shown herewith, which is used on the A.B.B.Werkspoor engines, the illustration being a revision of a shop drawing. It is also used by other engine manufacturers. In this instance the drawing was made from the work, in place of the work being made to the drawing, a trick that is done oftener than most draftsmen care to admit.

The first set of packing was made up in the engine-room workshop out of a piece of scrap brass and some babbitt. It proved to be simple to make. Any good mechanic can do it.

The ring *A* at the top of the stuffing box and *B* at the bottom replace rings that were formerly used with loose packing. The rings *C* are made of babbitt and *D* are made of brass. The babbitt rings are a neat fit on the fuel-valve spindle *F*, but not on the stuffing box. The brass rings are a neat fit in the stuffing box, but not on the spindle.

The assembly is made as shown in the illustration, and when the nut *E* is screwed down on the top ring, the pressure tends to cause all the brass rings to cramp the babbitt ones tight against the spindle. To prevent seizure in operation, lubrication is provided by filling the grooves in the babbitt rings and all the space about



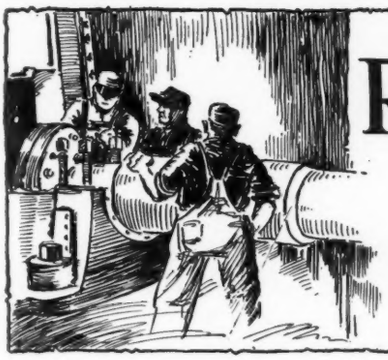
The fuel-valve packing recommended

the rings with cup grease when assembling, after which the spindle is slipped through the assembly.

After the engine starts, the packing may leak at first, in which event it should be tightened up carefully until the leakage stops. Taking up on it too quickly will cause it to seize and damage the packing.

This method of packing cannot be used on spindles that are worn small where the packing bears. It is not a cure for an existing bad condition, but a preventive.

I had one set in use for two years without wearing out and without wearing the spindles. We were always careful not to get any grinding compound in it, and each two weeks we removed the spindles and repacked the grooves with grease. Sometimes it would run for three months without having to take up on the packing nut. When we did take up, we had to be careful not to pull down too hard. About an eighth of a turn generally did the trick.



Reminiscences of an Engineer

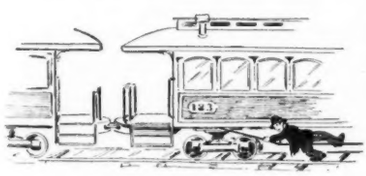
By Hubert E. Collins

The Three Musketeers in the Power Plant

AMOS and Steve had drawfiled the last connecting rod of the triple-expansion vertical engine. It had been assembled on the erecting floor, then dismantled, parts crated and shipped, when Dan came to Al and Harry with the news of the three being selected as the erecting crew. With Dan came Dave, the Barbadian helper at erecting on many new engine sets. Dave had arrived in town scenting a job, via the truss rods of the fastest express; no side-door Pullman for that gentleman of color. Dave always served as chief helper, by reason of familiarity with the job and his willingness to work.

The "Three Musketeers" of the Williams shops were directed to go to Brooklyn, find the Pearl Street Edison Station, and there erect the first engine of 1,200 hp. designed by their chief, the largest in the station they were to serve.

Al and Harry accompanied Dave to the railroad yards in Youngstown the night they received their orders, and saw him swing into place under the observation car. They knew he would be in Brooklyn when they arrived. The trio took train the next night, arriving in the home of baby carriages the following day. Reporting to Mr. Guillandieu, chief of the station, they were shown to the engine room, scene of their coming labors, and there found Dave awaiting their arrival with an expectant, cheerful grin.



While preliminary work was under way, the men had time to study the ground.

The Pearl Street Station of the Brooklyn Edison Company had started with an equipment of high-speed, horizontal engines belted to generators of the first Edison design. These units were in an engine room on the second floor, with the boiler room on the ground level.

To meet the growing needs of the city, the building had been extended along Pearl Street and the new engine room designed to accommodate the largest vertical engines of that period, which took upward of twenty feet headroom. There were to be six or more of the new type engine-generators, placed two in a row, end to end, with the bases at the street level. But for the new steam-electric units the room would be empty, for the condensers, pumps and steam piping were below the floor level. The building roof was carried over this space at the same level as the older two-storied building. The far side of this space was occupied by a gallery, into which opened the chief's office and which contained the switchboards. These were reached by a spiral stairway from the new engine-room floor. The front of the room had large plate glass windows extending the full length, thus affording the public a view of the place as people passed on the street.

At the time of this story the old engines, boilers and generators were still in use, while new boilers had been added and were ready for service. The front of the new engine room held a row of the first two vertical engines, each a Williams, of 800 hp. Steam mains in place below the floor level were of size to serve the total requirements of the new engine room.

Work went forward at the fastest pace possible; the Three Musketeers directed the men, who worked with might and main. Overtime became the order of the days and nights. Then the steam for testing was called for and the operating crew under Manning sought to furnish all that was needed. A newly installed Holly system had been placed to drain the piping system, but was not functioning properly—others than the erecting crew were having troubles.

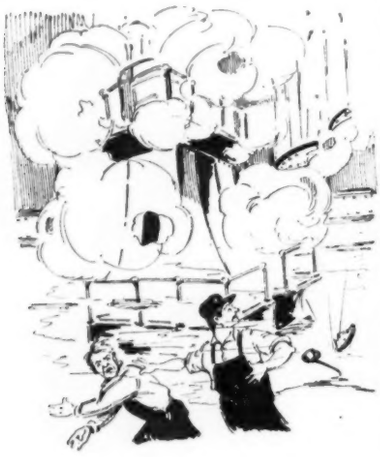
Steam was carried to the engine throttle and water surged in the main, pounding on the tee at the end of the line. A small amount of steam was admitted and the inert mass of machinery came to life for the first time as it slowly carried over centers. This steam was left seeping through throttle, just enough to keep the engine moving, to wear in the bearings.

Soon the water hammer became insistent; all hands of the erecting crew stood watching the operators as they frantically rushed about, trying a valve here to note if it were open, closing others or starting drip pumps. The trouble steadily grew worse; surges tugged at the whole line of piping and carried it to the limit of lost motion and loose pipe threads. Valve spindles in the floor stands vibrated three and four inches at the ends, as the pipe plunged on its hangers. The station was filled with the

sounds; building and foundations trembled with the terrible impacts. Manning and his men seemed powerless to stop the threatening disaster.

Finally, every person not engaged was standing about watching the efforts to abate the trouble. The Three Musketeers, having seen such trouble before, were seriously apprehensive, Chief Guillandieu the same. The latter stood looking from the gallery, Dan from a position ten feet from the new engine foundation on the temporary flooring, Al looked on from the middle deck of the engine, while Harry took stand on the permanent floor between the first two rows of engines. Others stood in various positions; people were attracted on the street and gazed through the plate glass to see—they knew not what.

A final surge was succeeded by a terrific roar and rush of steam. Pandemonium broke loose as clouds of vapor released from 150 lb. pressure hissed and roared into the station, filling every space, spurting from every crevice and opening. Through the blinding fog, which was forced to every part of the room, came the plunging body of Manning as he rushed toward the boiler-room valves; it was before the day of automatics. To the boiler room he had to find his way, up moisture-dripping ladders, over boiler tops to find the valves in the dark. It was not long before he had the valves closed and a silence succeeded like that of eternity, compared to the bedlam of Hell just passed.



Dan had long legs in that six-foot three-inch body and they saved him. The temporary floor on which he had stood was blown entirely away with the explosion. With the lift of the floor Dan had leaped ten feet to the safety of the engine foundation, and held himself there a moment as he looked into the yawning chasm, over which he had stood. Blinding steam blotted out the scene and made it too hot to remain there, so he crawled on to safety. Al stayed where he was on the engine platform and weathered the scalding steam clouds without breathing in a fatal portion. Harry saw Dan make his leap, disappear in enveloping vapor, knew his friend was safe, stood his ground until quiet was restored again.

All hands were soon counting up damage created by the explosion. The 16-in. steam main had been wrenched loose at a fitting near the boiler-room wall. This mass of metal moved forward to a 30-in. brick wall and passed through it as through cardboard, stopping only when held back by a cross-fitting. The temporary floor of three-inch plank had gone up like a pile of straws. Some of the beams had struck the ceiling of the engine room and either penetrated or left deep marks. The scattered beams and planks lay all over the confines of the engine room, on floors, machinery, and in the gallery. But for all the damage caused by the explosion, not a man was injured.

This accident delayed putting the sorely needed engine into commission. It had ceased to rotate when the steam line gave way and was not put in service until several days after. Of course there was a spell of work for the operators as they cleared up the wreck and repaired the damage. After a few days there came the word that all was again ready to try the new engine. More excitement came with the starting of that unit.

At the appointed time Pop Hulse was in charge on the floor. An old man in engineering, he was as cheerful a man as could be found. He was ably assisted by Charley Thomas as oiler. The custom of the station was to work an engine up to speed as the electrician built up voltage at the board in the gallery. When the governor took hold, the engineer called out "All right," and the electrician then threw in the switch as the engineer spun the throttle wide open and then backed it a turn to the running position.

Pop was at the throttle this Sunday night; he opened her up, eased her over centers, warmed her up and worked her up to speed in proper style. As the governor weights swung out and the springs drew them into line, Pop raised his head until his white beard stuck out at right angles to his Adams apple, held his dudeen upside down in clenched lips and managed to be heard above the roar of engines in full action as he yelled, "All right."

He was heard, for above the roar came the resounding smack as the switch was socked home to tie the new unit to the line. With the smack of the switch barely over, came a terrible crash and blinding steam, carried scalding water over the place once again. Pop had not left his position at the throttle, and as the rain of cast-iron chunks, hot water and steam vapor shut him from view, he was seen spinning the throttle wheel to a shut-tight position. The trouble hardly started before it was brought to a stop by the nervy old man.

When others could go to him, Pop resigned the engine back to Dan, the erecting boss. It was now up to the Three Musketeers to get busy; Manning passed his rush of work on to them. The three had been present to witness putting their engine into service and a cog had slipped.

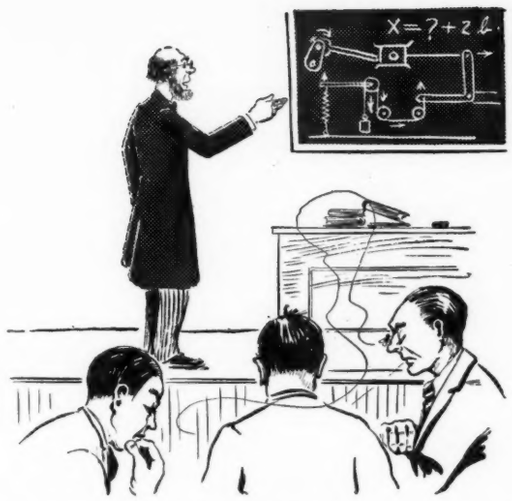
Immediate examination revealed a broken high-pressure piston head. The head was in pieces all over the place, some in the switchboard gallery. The piston rod was badly bent, the cylinder head broken in pieces, even high-pressure valves broken and the cylinder bore dented with flying chunks of iron. Here was a wreck, the cause of which had been water introduced into the cylinder by the surges of steam when the steam pipe had failed.

Setting to work at once, the Three Musketeers started to repair the damage, for if the company had wanted the engine when the steam pipe burst, the urgency was intensified at this time. Clearing the wreck, repairing parts that could be salvaged, telegraphing the shop for missing essentials, babbitting, scraping, lifting into place and bolting down, they took only time to eat, and very little of that.

After the forty-hour period of work, they turned the engine over to the operating force again and saw them put it into service without accident this time. Pop was at the throttle and did not flinch when he heard the smack of the switch, and all went well.

The other engine was erected and placed in service without hitch. Thus was the public served, the public which often grouches at the public service operators, without thought of the action of those behind the scenes.

This tale simply draws attention to incidents such as are enacted in power houses year after year, all over the world.



WHAT DO YOU KNOW?

By L. H. Morrison

The answers are on page 868

Ques. 1—Upon what evaporation, in terms of pounds of water per square foot of heating surface, are boilers rated?

Ques. 2—A motor driving a number of machine tools has an output of 10 kw. Where does this energy ultimately go?

Ques. 3—If you compress air to, say, 100 lb. gage and cool it back to its original temperature of, say, 60 deg. F. while keeping the pressure constant at 100 lb., will the air have more or less heat than it had before compression?

Ques. 4—What is a "Ringelman" chart?

Ques. 5—What American Diesel engines use mechanical injection of the fuel in connection with a needle valve control of the time of injection?

Ques. 6—How large have Diesel engines been built in this country?

Ques. 7—Is it possible for ice to change into water vapor without it becoming a liquid as an intermediate stage?

Ques. 8—What is the advantage of operating a boiler at 3,200 lb., the critical point?

Ques. 9—Why is cork board a good insulation?

Ques. 10—What industry uses the greatest amount of coal?

Tuning Up an Engine by the Indicator

By J. W. Morton

AFTER a large oil engine has been started and has warmed up to the running temperature, it is well to take indicator diagrams from each cylinder in order to judge if the power is being evenly distributed and also to see if the timing of the various valves is correct. Once the engine is started, the chief engineer does not care to have a stop unless absolutely necessary, and any adjustments to valves that are considered advantageous to the working of the engine or engines must be carried out if possible while the machinery is running. To do this an exact knowledge is required of the effects of alterations to the valve settings.

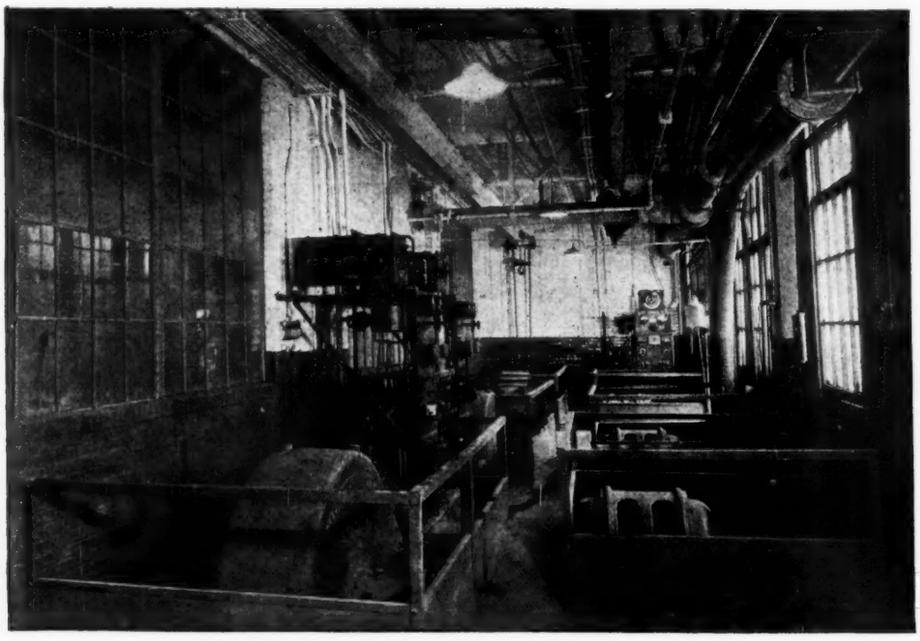
By taking complete sets of indicator diagrams, one for each cylinder, examining and comparing them with one another, the engineer is able to detect any deviation among the cylinders. By means of pull diagrams and analysis from a series of diagrams, he is able to discern the nearly perfect one. With this one as basis, he can change the fuel supply, air or valve setting for those cylinders whose diagrams deviate from this normal or standard. The idea is to distribute the power equally among the cylinders in addition to having perfect combustion in all of them.

The largest interest focuses itself around the peak of the diagram where ignition and combustion take place, but unfortunately, at this part of the diagram the indicator drum is almost at a standstill and the ignition is hard to analyze, as it is very short and the pencil tracing is in the form of a peak.

A truer picture of the conditions of the combustion is obtained by a so-called pull indicator diagram, where the combustion occurs around the middle of the figure. To obtain a good "pull" diagram requires some skill. The indicator drum is pulled around by the hand, and it is best to begin the pull when the engine piston is at the bottom of its stroke and stop pulling when this piston has traveled once up and down. Some indicator rigs, however, provide automatically for taking these diagrams by having the indicator pulling mechanism so arranged that the drum motion is offset 90 to 120 deg. from the travel of the engine piston. This arrangement gives a clear and at all times uniform picture of the working fluid's behavior inside the cylinder with a minimum waste of the operator's time.

Why Not Know?

No plant should be without instruments in addition to the steam gage. In general the determinations of coal weights and the water evaporated are the two main items, but draft gages, flow meters, temperature recorders and CO_2 machines all help maintain good operating conditions. How many engineers of the smaller plants are required to give an account of their stewardship, often in thousands of dollars worth of coal burned each year? What percentage of this expenditure goes up the stack in avoidable waste and how much is lost to the ashpit in avoidable loss? These and other questions can be answered by daily records established with the proper instruments.—*Statement made by H. C. Carroll at the recent Indiana Fuel Conference, Purdue University.*



Three 600-hp. synchronous motors drive mill lines through reduction gears.

DYNAMIC BRAKING

Quickly Stops Synchronous Motors

BY K. B. SPEAR

Industrial Control Engineering Department
General Electric Company

By disconnecting the stator winding from the line and connecting it through a resistance and leaving the fields excited, the motor and its load can be stopped from full speed in about one second.

SYNCHRONOUS motors are unique among alternating-current motors, in that dynamic braking may be utilized to obtain a quick stop. While plugging —that is, reversing the current in the motor to reverse rotation before the rotor has come to rest—may produce the same result, dynamic braking has several advantages. For example, the motor may be brought to rest more quickly. Also, the alternating-current source is not relied on for the quick stop, as is the case with plugging control. This is important where human life may depend on the quickness and certainty with which the motor is stopped.

An example of this is to be found in rubber mills where synchronous motors are used for driving mill lines. To safeguard the lives of workmen who might be caught in the mill rolls, the dynamic braking is controlled through an emergency switch on the mill itself. This switch is so located as to be tripped by contact with a man's body and, when tripped, will accomplish a dynamic braking stop in less than twelve inches travel of the rolls.

Dynamic braking is also of importance in steel mills and in lumber mills, where synchronous motors are used to drive the head saws. Here a quick stop is desired when saws are to be changed, since production is at a standstill while these saws are idle. A synchronous motor may be stopped by dynamic braking in from one one-hundredth to two one-hundredths of the normal revolutions per minute of the machine, depending upon the flywheel effect of the load and the characteristics of the motor. A motor running at 400 r.p.m. would thus be stopped in from four to eight revolutions.

Dynamic braking of a synchronous motor is accomplished by disconnecting the stator winding from the line and short-circuiting it through a resistor. The field remains normally excited and the machine runs as an alternating-current generator supplying energy to a resistance load, where it is dissipated as heat. The kinetic energy of the rotating parts is thus expended, and the armature is brought to a standstill.

Figs. 1 and 2 show a typical control panel, combining automatic reduced-voltage starting, dynamic braking and hand reversing control for a synchronous motor. The complete equipment is mounted on one panel, including the starting and running contactors, field relay and contactor, dynamic-braking contactor, auto-transformer and dynamic-braking resistor. Timing relays, alternating-current and direct-current ammeters, and the rheostat

mechanism are also part of this equipment. A push button for start and stop, an emergency stop button and a reset push button are mounted on the panel. Direct-current excitation must be present before the equipment can be started, and failure of excitation at any time will shut down the motor. The panel operates as follows:

Controller Operation

With direct-current excitation present the operator presses the reset button. This is necessary only after an emegrency stop or after failure of excitation. A control relay is energized, connecting the control circuit to the start button. Closing the control relay also energizes the spring-set dynamic-braking contactors, disconnecting the resistor from the motor armature. This relay must close before the motor can be started, thus assuring the operator that direct current is available for dynamic braking during the starting period.

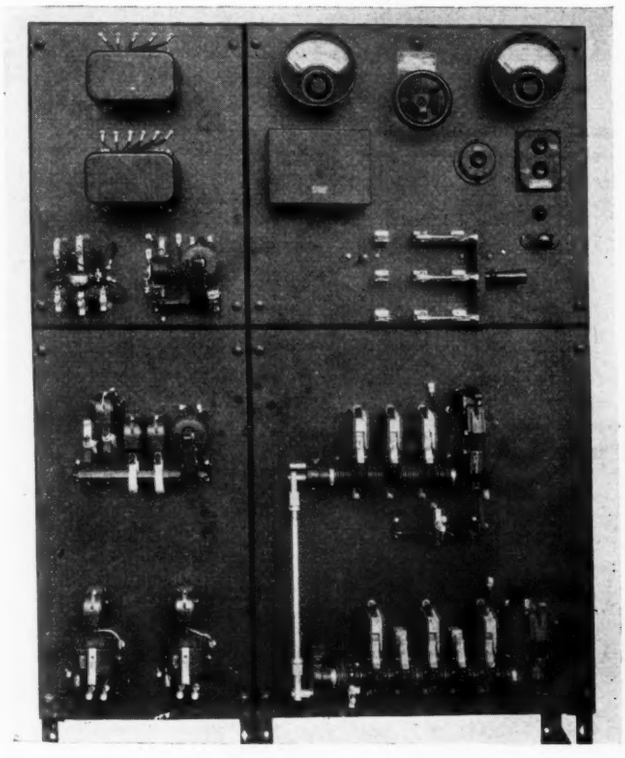
Pressing the start button energizes the accelerating contactor, connecting the auto-transformer to the line and the motor to the taps of the auto-transformer. Simultaneously, a definite-time relay is energized. After a time interval corresponding to the setting of this relay, the accelerating contactor opens and the line contactor closes, connecting the motor directly to the line. When the motor reaches approximately 95 per cent of synchronous speed, the contacts of the field-actuating relay are closed. This closes the field contactor, connects direct-current excitation to the synchronous-motor field, causes the motor to pull into synchronism and completes the starting operation.

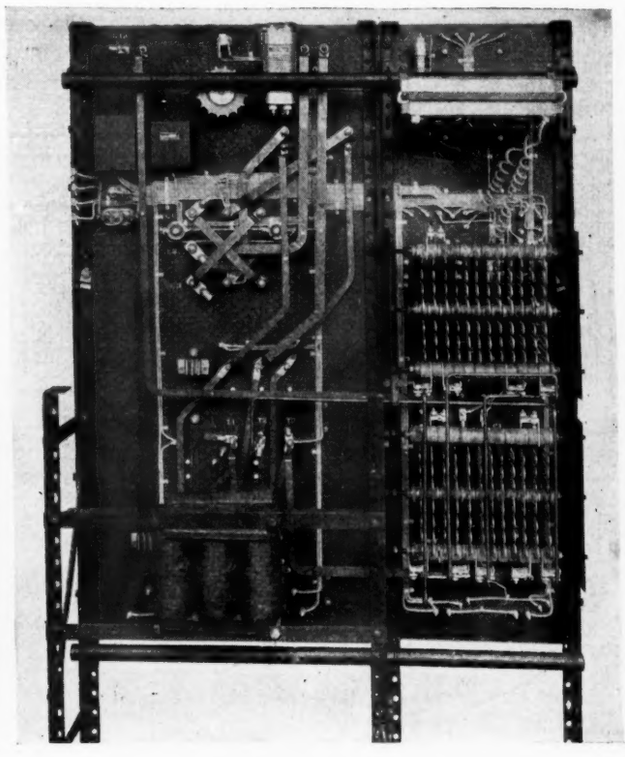
By pressing the stop button, all control circuits are de-energized and, as the field contactor opens, the field of the synchronous motor is short-circuited through the field-discharge resistor.

If an emergency stop is desired, the emergency-stop button is pushed. This may be the emergency button on the panel or one of a number located at suitable points in the mill. Pushing an emergency-stop button or switch de-energizes the control relay. One set of opening contacts on this relay cause the line contactor to drop out, while the closing contacts keep the field contactor closed, thus keeping the motor field excited. Another set of opening contacts on the control relay de-energizes the dynamic-braking contactor coils. Since the dynamic-braking contactors are of the normally closed type, spring-set, the contactor tips are instantly closed, connecting the motor armature to the dynamic-braking resistor. The motor comes to rest almost instantly. Even if the operator has the stop button closed, the equipment will be subject to dynamic braking provided one of the emergency switches is operated.

Since it is desired to remove excitation from the motor field after the motor has stopped, this is automatically accomplished by a second definite-time relay. This relay starts timing when the emergency switch is operated and opens the field contactor after a predetermined time sufficient to allow for the dynamic-braking action to take place.

With this control it is possible to subject the motor to dynamic braking at any time during the starting, running, or stopping period. Tripping of the overload relay will also bring about dynamic braking. A white pilot light on the control panel indicates line voltage, while a red lamp indicates the presence of direct-current excitation, necessary for dynamic braking. Thus the dynamic braking provides for synchronous motors a quick stop, and it acts independently of any conditions that may exist in the main power supply.





Figs. 1 and 2—Front and rear views of automatic starter with dynamic braking for a 200-hp. 600-volt synchronous motor driving a rubber mill

Open-Delta Transformers Compared With Closed-Delta

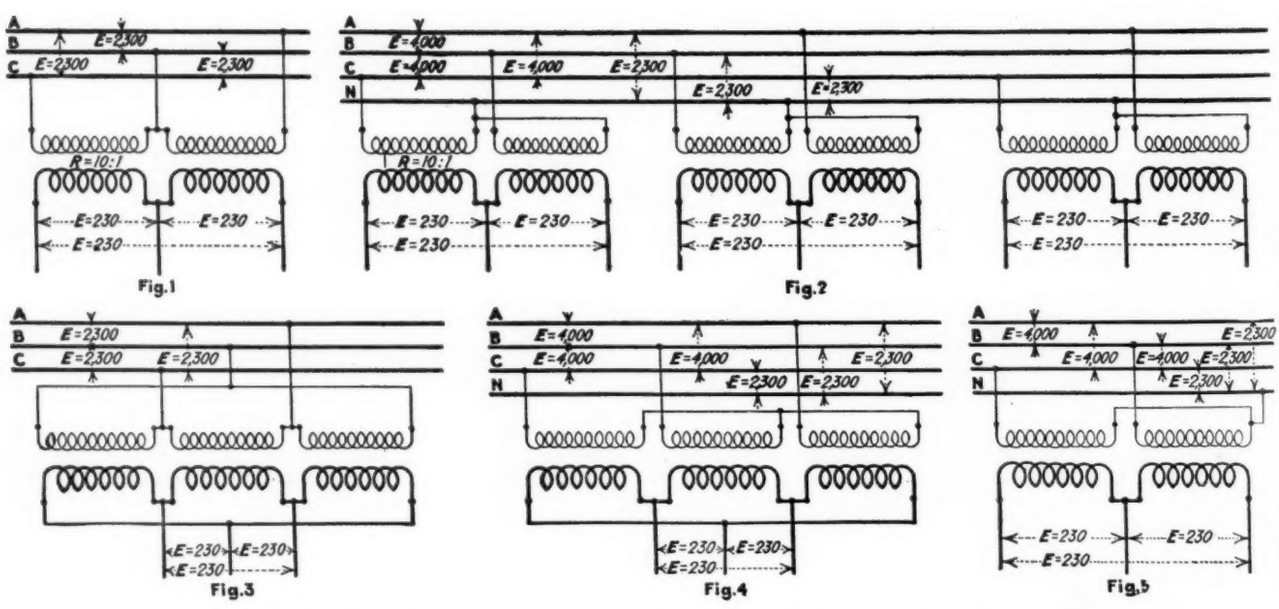
By A. C. Simpson

ON THREE-PHASE circuits it is quite common practice to connect two transformers open-delta to supply power service. On a three-wire three-phase circuit the connections are made as in Fig. 1, and on a four-wire three-phase line each pair of transformers are connected as in Fig. 2. When using transformers this way, there are certain economic considerations in the form of financial savings and satisfactory service that should be taken into account. These factors are modified by the size and location of loads and the class of service to be rendered.

The advantages of using two transformers connected in open-delta as in Figs. 1 and 2 instead of three connected as in Figs. 3 and 4, are not as pronounced as is generally assumed and this will be apparent from a consideration of the table. In this table three 5-kva. transformers are compared with two 7.5-kva. units, three 10-kva. with two 15-kva. transformers, etc. It is understood that under normal conditions 15 per cent more transformer capacity is required to supply the same load from an open-delta connected bank as compared to three transformers connected closed-delta. For practical purposes more transformer capacity is usually installed than is required for the connected load. Therefore it will be assumed that the same transformer capacity can be installed whether the open-delta or the closed-delta connection is used.

In the second column of the table, under "Unit Cost Installed," all the costs involved in putting the transformers into place and connecting them up are included, such as labor, material and other contingent expenses. These figures are for installing the transformers out of doors. The total annual costs have been computed for four different pairs of transformer-bank capacities.

The carrying charges, which include interest on investment, amortization, taxes, insurance, etc., have been taken at 15 per cent of the unit cost installed and are given in the third column. This cost can be varied to suit conditions, but 15 per cent is the figure used by one power company. The core loss figures are typical for transformers of a well-known manufacturer. As given in the fifth column from the left, the core-loss costs per year are based on the core loss per transformer and number of transformers in the bank, times $0.02, the cost



Figs. 1 to 5—Transformer connections on three-wire and four-wire three-phase lines

Fig. 1—Two transformers connected open-delta on a three-wire, three-phase line. Fig. 2—Three open-delta banks on a four-wire, three-phase line. Fig. 3—Three transformers connected closed-delta on a three-wire line. Fig. 4—Three transformers connected star-delta on a four-wire circuit. Fig. 5—Shows how one transformer may be removed from the bank, Fig. 4, and service rendered with two transformers connected open-delta, and obtain 58 per cent capacity of the closed-delta bank.

of energy delivered at the transformers; times 8,760, the hours per year.

A load factor of 0.28 is used and is the same as that of an Eastern power company. This may be considered typical for average industrial loads and is the load factor used in calculating the copper losses. The cost of copper losses per year is calculated as the copper loss per transformer times the number of transformers in the bank; times 0.28; times 8,760, the hours per year; times $0.02, the cost of energy delivered. For example, the cost of the core losses in three 10-kva. transformers is equal to $190 \times 3 \times 0.28 \times 8{,}760 \times \$0.02 = \$28$.

When two transformers are connected open-delta, the current in each transformer for the same kva. load will be 15 per cent higher than for the closed-delta connection. Since the copper losses increase as the square of the current, they will be about 32 per cent higher in the transformers when connected open-delta than when grouped in delta-delta or delta-star. Therefore, when calculating the copper losses of the open-delta connected transformers, the result for two normal transformers is multiplied by 1.32. To take care of this, the copper losses for the open-delta connected transformers in the table, the normal full-load copper losses, have been increased 1.32 times.

YEARLY COSTS OF CLOSED-DELTA AND OPEN-DELTA CONNECTED TRANSFORMERS

Transf. Bank Kva.	Cost Installed Dollars	Carrying Charges 15 Per Cent	Core Loss Per Trans., Watts	Core Loss Per Year @ $0.02 Per Kw.-Hr.	Copper Loss Per Trans., Watts	Copper Loss Per Year @ $0.02 Per Kw.-Hr.	Total Yearly Cost
3–5	314	47.10	38	19.95	108	15.90	82.95
2–7½	262	39.30	50	17.50	195	19.15	75.95
3–10	435	65.25	60	31.55	190	28.00	124.80
2–15	375	56.20	80	28.00	347	34.00	118.20
3–15	537	80.60	80	42.00	263	38.70	161.30
2–25	498	74.80	120	42.00	515	50.50	167.30
3–25	730	109.50	120	63.00	390	57.40	229.90
2–37½	665	99.70	160	56.00	726	71.20	226.90

Total Yearly Costs

From the table it will be noted that there is practically no difference in the total yearly costs of the two sets of transformers. Therefore any advantages that would warrant the installation of open-delta connected transformers must come from other considerations. The first cost is less, but this is not of any consequence unless a large number of transformers are being considered. The figures given in the table may vary with different conditions, but not enough to affect the comparison materially.

One of the objections to using open-delta connected transformers on a four-wire circuit is the difficulty in balancing the load. It requires three banks, connected as in Fig. 2, each bank carrying equal load to give a balanced load on the system. With a three-wire system, Fig. 1, a balanced load on the system is obtained if the load is balanced on the two transformers. On a 2,300-volt three-wire system three transformers may be connected delta-delta, as in Fig. 3, to step down to 230 volts. These same transformers may be connected star-delta, as in Fig. 4, to obtain 230 volts from a four-wire 4,000-volt system. The three transformers have the added advantage that in case of a failure of one transformer on either the three-wire or four-wire system the two remaining transformers may be connected open-delta as in Figs. 1 and 5 and supply a load equal to 58 per cent of the combined rating of the three transformers. With the open-delta connection, if one transformer fails the power supply cannot be restored until the transformer is repaired or a new one provided.

The type of service to be rendered is an important factor in determining whether the open-delta or the closed-delta bank should be installed. While actual money saving, under certain conditions, may be shown in favor of the open-delta bank, the intangible cost of an interruption may overcome the apparent saving many times. It is important to consider the type of feeder to which the bank will be connected; that is, whether the feeder is entirely overhead, underground, part overhead and part underground, a radial or loop, and the means provided for sectionalizing in case of trouble; also, whether the transformer bank is on a pole, in a transformer room, and whether the primary feed is overhead or through an underground lateral.

There is one important exception to remember, not from the viewpoint of interruptions, but from the point of supplying lighting service free from flickers. It has been found with two 25-kva. transformers connected open-delta and feeding a 35-hp. motor located on an overhead line three or four miles from the station, that flickers have been produced in residence lamps in the neighborhood. This is due to excessive neutral-wire voltage drop, which reacted through the lighting transformers connected to the same phase wires and neutral. The flickers can be prevented by the installation of a closed-delta bank. In order to avert this occurring, the primary voltage drop can be calculated prior to installation, and if found to exceed 40 volts where 10 to 1 units are to be used, the third transformer should be called for on the initial installation.

Summing up, it can be said that under certain conditions the open-delta bank can be used to advantage, but where continuity of service is paramount, certain factors must be considered. Some additional line capacity can be provided by its use on a four-wire system, but may require replacing the cable feed outs from the station for a short distance, to accommodate the increased load which has returned to the phase wires at these points. This means, of course, that when the open-delta banks are installed, precaution should be taken to keep them balanced on alternate phase wires in the field.

Armature Loose on Shaft Caused Insulation Trouble

By M. E. Wagner

A 15-HP. direct-current motor gave trouble due to the leads to the commutator breaking, and at other times the insulation at the commutator end of the armature slots failed and grounded the coils. The armature had been repaired a number of times, and then it became necessary to put in a new winding. After the armature was stripped, it was found that there were indications of a movement of the core on the shaft. A test showed this to be true.

When the core was removed from the shaft, the keyway in the core was found to be larger than that in the shaft. This allowed the armature to move on the shaft sufficiently to chafe the insulation of the coils where they came out of the slots and also to break the leads. Cutting the same size keyway in the shaft as in the core and installing a new key cured the fault. The armature was rewound and gave no further trouble.

Why a Cake of Ice Brought No Profit

By C. T. BAKER
Consulting Engineer, Atlanta, Georgia

ABOUT a year ago I was asked to make a report on two different plants, one being a straight ice plant and the other a combination ice and electric plant. Both were showing unsatisfactory results.

In the combination plant, an inclosed type of ammonia compressor was operated by a belt from an oil engine running at 300 r.p.m. To the crankshaft of this engine was connected a second shaft by means of a clutch which furnished power to the auxiliaries as well as driving a 2,300-volt generator to take care of the principal ice plant auxiliaries in the event current from the main electric plant should fail. The layout is shown in Fig. 1.

Investigation disclosed that the compressor drive had been very poorly arranged, for the engine's direction of rotation was such that the slack side of the belt to the compressor was at the bottom instead of at the top, with resulting loss of belt grip.

In order to overcome the troubles incident to such an arrangement, a home-made idler had been provided, which, in addition to being crude, resulted in a waste of power. I recommended that the engine governor be equipped with the necessary mechanism to permit the reversal of the direction of rotation. This would bring the slack side of the belt to the top and do away with the cumbersome idler arrangement.

At the same time it was recommended that the small generator be relocated, placing it on the opposite side of the engine crankshaft, so that the same advantages of proper belt drive would obtain as in the case of the ice machine.

The Trouble with the Condensers

An examination of the ammonia condensers, which were of the double-pipe type, disclosed that while the condensing capacity installed was ample for the plant requirements, the inner tubes had not been cleaned in a long time, with the result that they were coated with rather a heavy deposit of dirt. This coat acted as an insulator to reduce the heat transmission between the ammonia and the condensing water and at the same time caused high condensing pressures.

Investigation showed that the system was badly fouled with air which also contributed materially to the high pressures.

The plant was shut down and given a preliminary purging and after being started up showed a reduction of 15 lb. in head pressure even though all the air had not been removed. The engineer was advised to continue purging each day until the pressure approximated normal conditions.

As it was not possible to secure sufficient condensing water from wells on the premises, it was necessary to recirculate the water and cool it by means of a cooling tower. Investigation disclosed that someone had hit on the idea that a good way to save water would be to partly close up the space between the top of the basin foundation wall and the bottom of the louvers, which was about two feet, and thus eliminate loss due to splashing. To accomplish this, large strips of metal screens had been placed on two sides of the tower and partly across one end. This, of course, had the effect of materially reducing the amount of air that could pass upward through the tower and, consequently, the effective cooling.

The freezing tank, which was of the low-pressure raw-water type, provided with the usual direct-expansion coils, was equipped with an accumulator on the suction for the purposes of returning any liquid ammonia that might be carried from the coils with the suction gas back to the coils through a proper drain at the bottom.

They Look Into the Cold Storage

Next to the freezing tank was the ice-storage room, which was refrigerated with 2-inch direct expansion piping. The suction from the coils of this room was tied in to the main suction line between the compressor and freezing tank accumulator, in place of being connected between the freezing tank and accumulator, so that any liquid carried over from the direct-expansion coils would be removed by the accumulator. Since this plan had not been followed, and since the storage room was small and the coils in it were short, it was difficult to control the expansion valve so that the liquid would not pass over to the compressor.

As a result, liquid would often come over in large quantities and cause the discharge pipe to cool sufficiently to contract the flanged joints, causing ammonia leakage. It was recommended that a simple change in the piping be made so as to introduce the suction gas from the direct-expansion piping into the main suction line between the freezing tank and the accumulator.

In the second plant, which was owned by the same company and which was also a raw-water type using low-pressure air for the agitation of the water in the cans, it was found that the principal trouble was one of

under capacity. This condition was the result of no one particular thing, but a combination of a number of things. For example, the engineer had decided that in order to insure full weight of ice to all customers, it was necessary to increase the amount of water to the cans well beyond that which was needed to give a reasonable overweight, and instead of the usual five to seven pounds overweight he had adjusted the can filler until the cakes of ice averaged 325 lb. each. This, of course, was out of all proportion to that which is normally allowed on a 300-lb. cake. It is evident that with a total of 450 cans in the two tanks installed, a lot of overweight was being frozen. The can fillers were reset to fill the cans with 305 lb., which meant a saving of 20 lb. of water per can. This, on a basis of 100 cans pulled per day, would represent a total of 2,000 lb., or one ton, of water saved per day.

The cooling of this water from 80 down to 32 deg. F. requires the taking up of 96,000 B.t.u., and for removing the latent heat to change the water from 32 deg. into ice at the same temperature, requires an additional 288,000 B.t.u., quite an item.

As Usual, the Brine Was Weak

It was found also that the brine was very weak, registering only 55 on the salometer, corresponding to a specific gravity of 1.103 and a freezing point of 14 deg. F. Approximately 4½ tons of salt was required to bring the brine up to the proper strength. The brine had been allowed to get low in the tank with the result that one pipe on each coil was uncovered, and since the coils were ten pipes high, with one pipe above the brine, this meant that 10 per cent of each coil was doing no work. It was found that the liquid outlet of the ammonia

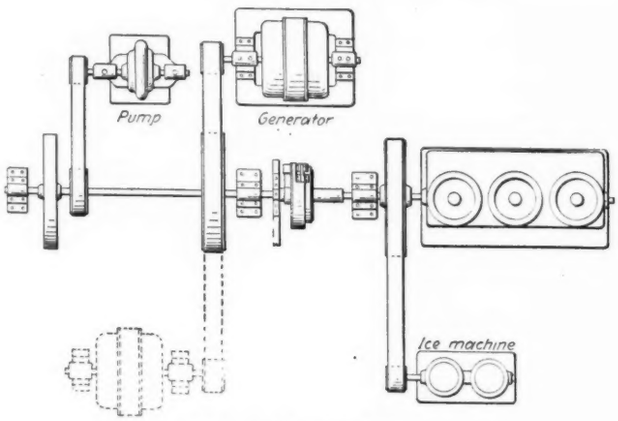


Fig. 1—The original belt arrangement

receiver was not sealed and that gas was passing directly to the expansion valve. In checking up the amount of ammonia required to charge this plant properly, it was found that the requirements would be approximately 600 lb. It is evident that here was one of the principal reasons for loss in capacity.

It is interesting to know that after these minor troubles were corrected, the plant could be operated at full capacity, the brine temperature could be held at the proper point without variation, and no trouble was experienced in getting the same amount of ice each day.

The same type of operating conditions exists in hundreds of ice plants. In fact, many ice plants have never made a nickel, if the proper carrying charges were set up against the plants. The owner counts his cash receipts—if they exceed the operating expenses, chuckles to himself

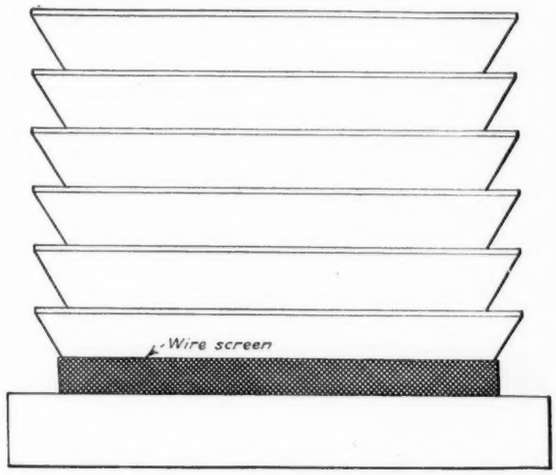


Fig. 2—The wire screen reduced the air flow

and at the next Rotary Club meeting acknowledges that he is "good." In fact, as a financial risk he is a real risk.

Starting a Plant After a Forced Shutdown

SUPPOSE everything is running perfectly in the refrigerating plant. Bang!—the power goes off. There is not much time to close all the valves and pump out the discharge line. One is lucky if even the suction valve can be closed before the machine stops. The other valves must be closed after all machinery has stopped.

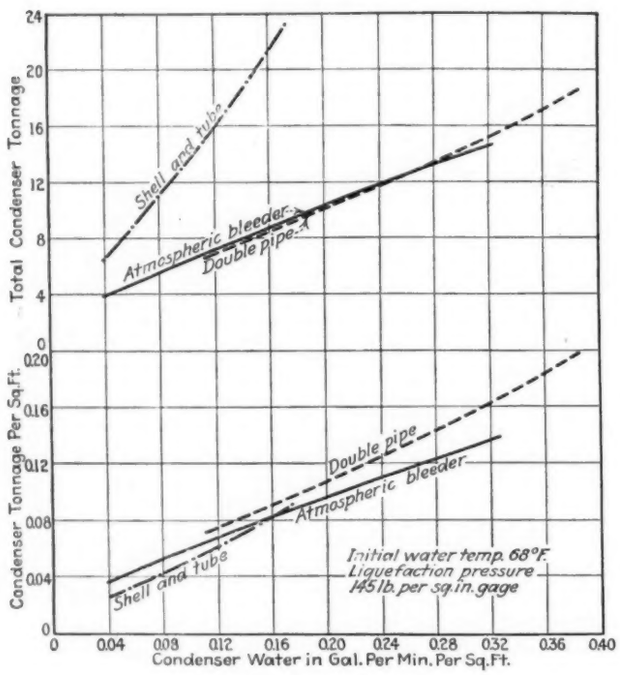
The discharge valves must not be opened before starting if there is much pressure on them. They should not be required to pump gas at more than 35 lb. gage through the bypass when the compressor is cold. Synchronous motors, generally used for compressor drive, are not of adjustable speed, so they should not be run on the induction windings more than 45 seconds.

In a case of this kind a good method of procedure is as follows: Close the king valves on the receivers and start the water over the condensers. See that all other valves and switches are in proper positions for starting. Start the exciters and adjust their fields for the proper voltage. The oiler should do the switching while the engineer attends to the valves, as new men can comprehend the switching much easier than the proper adjustment of the valves. The suction, discharge and bypass valves being closed, the oiler is given the signal to close the low-voltage switches that start the motor induction, and at the same time the engineer opens the small bypass which leads from the discharge to above the suction valve.

The warm gas is pumped out of the cylinder, and at the same time the liquid that may have collected in the suction header vaporizes and enters the cylinder. By this time the motor is ready for the load. When the cylinder is free from gas, the small bypass is closed and the discharge valve opened. The suction valve is then opened slowly to prevent getting a slug of liquid in the cylinder. After pumping the back pressure down to normal, open the king valves and readjust the expansion valves.

Heat Transfer in Ammonia Condensers*

ALTHOUGH tests of condensers have been reported at various times, the results have been isolated and more or less fragmentary. Accordingly, a systematic and rather extensive program of research was undertaken at the University of Illinois in order to correlate and give proper weight to the various factors



Comparative effectiveness of various condensers

entering into the design and operation of outstanding types of ammonia condensers.

To compare the performance of the three condensers tested, both the unit condenser tonnage and the total condenser tonnage have been plotted against the unit water rate for an initial water temperature of 68 deg. F. These results are shown in the illustration. Apparently, one square foot of surface is more effective in the double-pipe condenser than it is in the atmospheric bleeder condenser. Approximately the same increase in effectiveness with increasing water rates was obtained for both these condensers.

The rate of increase was much greater, however, in the case of the shell-and-tube condenser, and while the surface is less effective at low water rates than the surface in the other two condensers, it becomes more effective than either of the other two at water rates above approximately 0.20 gal. per sq.ft. per min. This effectiveness is undoubtedly influenced by the thickness of the layer of condensed liquid adhering to the surface and the ability of the surfaces to clear themselves of the layer at higher rates of condensation.

When the total tonnage developed was taken into consideration, the shell-and-tube condenser had the greatest capacity. The total area of the bleeder condenser exposed to saturated ammonia was 105.3 sq.ft., while that for the double-pipe condenser was 92 sq.ft. This difference slightly more than offsets the difference in effectiveness per square foot, and the capacities of these two condensers was practically the same. If the same external dimensions are retained, it is possible to obtain more area with the bleeder condenser than with the double-pipe, since the condensing surface is that of the inside pipes in the latter. The total surface exposed to saturated ammonia in the shell-and-tube condenser was 251 sq.ft. It is possible to obtain a greater amount of surface for the same floor space with this condenser than with the others, and apparently the surface could have been much reduced and a rating comparable with that for the bleeder and double-pipe condensers retained.

The tests indicate that at high water rates one square foot of the surface in the shell-and-tube condenser is more effective than one square foot in the other two condensers.

The greater spread of the curves for the shell-and-tube condenser indicates that the effectiveness of one square foot in this condenser decreases more rapidly with increasing mean temperature difference than it does in the others. This is true for the constant water rate. If, however, a constant initial temperature for the water is maintained and the water rate is increased, increasing values are obtained. Under these conditions the effectiveness of the surface in the shell-and-tube condenser increases more rapidly than that in the others.

The amount of superheat in the gas entering the atmospheric bleeder and the double-pipe condensers does not materially affect the amount of surface exposed to the action of saturated ammonia vapor.

For still-air conditions the loss in water due to splash from the atmospheric-bleeder condenser ranges from 0.5 per cent to 8.5 per cent of the total water feed to the condenser. This amount would be increased if splash strips between the pipes were omitted.

The condenser tonnage is a function of the water rate, and the initial temperatures require high water rates to develop the same condenser tonnages.

The thickness of the layer of liquid ammonia adhering to the condensing surfaces materially affects the rate of heat transfer per unit of surface.

The effectiveness of the surface increases more rapidly with increasing water rates in the shell-and-tube condenser than it does in the bleeder and double-pipe

*Abstracted from University of Illinois Bulletin No. 25.

condensers; at water rates above 0.19 gal. per min. per sq.ft., with an initial water temperature of 68 deg. F., it becomes greater than that for the other condensers.

In the atmospheric-bleeder and the double-pipe condenser from 37.0 per cent to 67.5 per cent of the total liquefaction may occur in the pair of pipes exposed to the coldest water. No appreciable amount of subcooling of the liquid occurs under conditions comparable with those in these tests.

An advantageous design for a condenser is one in which the condensate is removed completely and immediately from the condensing surface.

Why Evaporating Coils Leak

By G. Grow

FREQUENTLY, coils in brine tanks leak. This trouble may be due to poor connections or to imperfect pipe. Most leaks, however, are caused by pipe corrosion, both on the interior and exterior pipe walls. The cause of the internal corrosion is impossible of determination, but the corrosion and pitting of the outside walls are due to an electrochemical action set up by the presence of the brine. The greatest pitting occurs where the coils are alternately covered by the brine and exposed to the atmosphere.

The presence of ammonia in the brine, when it exceeds two pounds per thousand pounds of brine, often causes pitting, even if the pipes are galvanized. This takes place when any air or oxygen reaches the galvanizing. The oxygen combines with the zinc to form zinc oxide, and this combines with the hydrogen of the ammonia to form a zinc hydroxide. This leaves the pipe and a fresh surface is open to attack.

Should leaks occur, which may be detected by the presence of ammonia in the brine, the coil should be pumped out and, if the connection permit, removed and repaired or replaced by a perfect coil. In case there are two tanks, the brine may be pumped into the second tank after the cans have been removed.

Leaks into the water or brine are most readily detected with litmus paper or Nessler's solution. Litmus paper can be had at any drugstore or from the ammonia manufacturers. To use this paper, simply dip it into the suspected water or brine. If there is ammonia present, the paper will turn blue. Small traces of ammonia will barely color the paper, while any large proportion will turn it a deep blue. Litmus paper, however, will not give reliable indications in calcium brine. Calcium brine turns litmus paper blue just as ammonia will, and for this reason it is useless for detecting ammonia in this kind of brine. Instead, use Nessler's solution. It is also just as good as litmus paper, if not better, for salt-brine and water tests.

The formula for Nessler's solution is as follows: Dissolve 17 grams of mercuric chloride in about 300 c.c. of distilled water; dissolve 35 grams of potassium iodide in 100 c.c. of water. Add the former solution to the latter, with constant stirring, until a slight permanent red precipitate is formed. Next dissolve 120 grams of potassium hydrate in about 200 c.c. of water; allow the solution to cool and then add it to the previous solution and make up with water to one liter. Add mercuric chloride solution until a permanent precipitate again forms. Allow to stand till settled and decant off the clear solution for use. Put it in glass-stoppered blue bottles and set aside in a dark place.

In calcium brine Nessler's solution will always form a precipitate but if no ammonia is present, the precipitate will be almost white. In water or brine the precipitate will be yellow if there is but a trace of ammonia in the sample. To make the test, get a sample of the suspected water or brine in any kind of glass vessel and put a few drops of the solution into it. If it changes color, as stated before, the brine or water contains ammonia and preparations should be made to locate the leak.

An Open Road to Lower Costs

THE use and generation of process steam in an economical manner are important problems facing industry. Manufacturing technique is at a high point of development and permits but slight reductions in production cost to be made. But the steam used is not always either made or applied in the cheapest way. Improvements here offer an open road to lower costs and bigger profits.

With these facts in mind, two articles to be published in *Power*, May 22, are of importance. Theodore Maynz discusses the engineering basis for the selection of suitable generating equipment for process steam; while Graham L. Montgomery outlines the method by which Eli Lilly & Company attain a balance between their use of process steam and other power services. These articles should be helpful in pointing the way to improved plant economy.

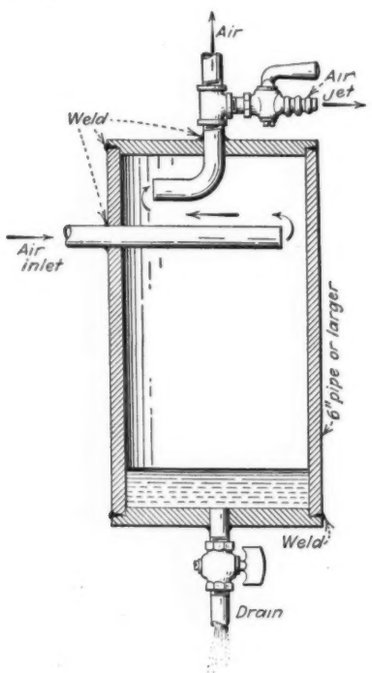
IDEAS FROM PRACTICAL MEN

For the exchange of practical information and ingenious expedients in operation and maintenance of plant and equipment

A Moisture Separator for Compressed-Air Lines

COMPRESSED-AIR supply pipe lines generally carry more or less moisture, and where varnish or paint sprays, gas torches, spray guns, etc., are used, many separators have to be furnished, because tools of this kind require dry air.

For this purpose we made a number of separators



Separator made from pipe with welded joints

from odd pieces of pipe, as shown in the illustration. These proved satisfactory and saved us considerable money.

T. NAMIKY.

Tokyo, Japan.

Effect of High Exhaust Pressure on Oil-Engine Operation

WE HAVE in our plant an oil engine that has until lately been a continuous expense. The expense of replacing burned-out piston-pin bushings, cleaning dirty pistons and cleaning carbon from the exhaust ports has been excessive compared to some installations of the same make in neighboring plants. This engine had the best of care, a good grade of fuel and the best of lubricating oil.

We had experts from the engine builder several times to clear up our trouble, but after a week of testing they would advise a change of fuel or lubricating oil and leave us with the same old trouble.

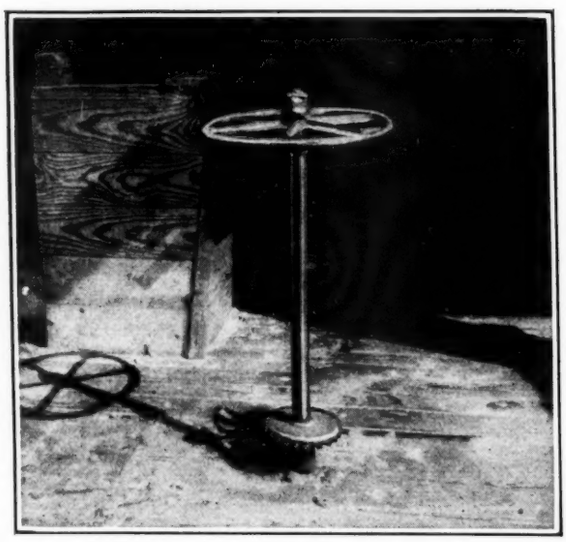
The engine was equipped with a pyrometer and had a thermocouple in each exhaust pipe. At no time had this pyrometer showed a higher exhaust temperature than was considered proper by the engine builder. Becoming suspicious of this pyrometer, we installed thermometers in place of the thermocouples and found that the true temperature was 125 to 175 deg. F. higher than was considered safe. In looking for the cause of the high temperature, we tested the exhaust pressure and found a pressure of $5\frac{3}{4}$ in. of water in the exhaust conduit. We then removed a manhole cover from the silencer, whereupon the pressure dropped to 2 in. of water and the exhaust temperature dropped to normal. The silencer was of the wrong design for the engine. We have had no trouble with this engine since lowering exhaust pressure.

H. C. CUNNINGHAM.

Pompano, Fla.

Attachment for Raising Belt Idler

IN CASES where a machine is operated with a belt slack enough when free to run freely around either the driving or driven pulley when the idler is released, the idler is frequently raised or released by means of a rope running over a sheave pulley above the idler and is pulled down by hand and hitched to an anchor. The weight of the idler is too great to be lifted without a



Handwheel and shaft are on the floor above the idler

lever or rope in most cases. The illustration shows a device we use for this purpose.

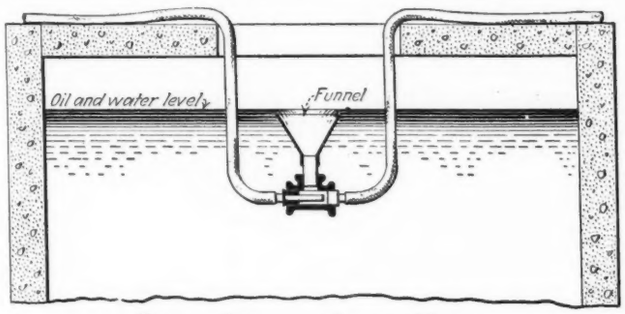
A hand-brake wheel and shaft with the chain attached was available, so this was erected on the floor above the idler. The chain is attached to the lower end of the rod and passes horizontally below the floor a few feet and over a sheave pulley to the idler frame. With this arrangement, when the wheel is rotated the chain winds on the lower end of the rod and lifts the idler, and the pawl holds it in position.

L. M. JORDAN.

Cairo, Ga.

Cleaning an Oil Tank Without Going Inside

RECENTLY, we found it necessary to clean the sludge out of an oil storage tank, and as this is a rather disagreeable job to do in the usual way, we tried floating the sludge with water and using the improvised skimmer or ejector shown in the illustration. As no standard ejector was available, we made one from a pipe tee by



Steam ejector used as a skimmer

fitting a steam nozzle in the run of the tee and a large funnel to the side outlet as shown.

To stir up the sludge in the bottom of the tank and cause it to float, we used a fire hose with the nozzle directed through the manhole in the top of the tank. When the level had been raised close to the top of the tank, we turned the steam on the ejector and then raised or lowered the funnel as necessary by means of the steam and discharge hose.

This method of cleaning the tank proved satisfactory. It also shortened the time usually required to do this work and otherwise simplified a rather disagreeable task.

Chicago, Ill. A. C. BROWN.

A Notebook of General Formulas Saves Time

A LITTLE study of the various problems that confront us daily, will not only save considerable time, but will also reduce the chance of error occurring in our every-day problems. Many of us become so closely tied to a handbook that we thoughtlessly do a lot of work that could be avoided if we kept a personal notebook of formulas and used it every day, and in which all possible factors are eliminated to suit our particular work.

As an example, if we wish to calculate the belt speed for a given diameter of pulley and speed, the diameter of the pulley will be given in inches, the speed in revolutions per minute, and the answer we wish is belt speed in feet per minute. If we are tied to a handbook, we will probably refer to a table giving the circumference of circles, for the circumference of the pulley in inches, then divide this by 12 to change it to feet, and multiply this by the r.p.m. to obtain the belt speed in feet per minute. As a formula this would read,

$$\text{Belt speed in ft. per min.} = \frac{\textit{diam. in inches} \times 3.1416}{12} \times \textit{r.p.m.}$$

By canceling 3.1416 and 12, we get a formula which reads, diameter in inches × r.p.m. × 0.2618, which is just as easy a factor to remember as 3.1416. In a mill where lineshafting is used, the various lineshafting speeds × 0.2618 can be tabulated, and this factor times the diameter of pulley in inches gives the belt speed in feet per minute.

The foregoing is a simple example, given only to show what I have in mind, but a little study of your own problems along this line is sure to reveal problems that can be greatly simplified in the same manner. A personal notebook of these formulas reduced to their lowest number of factors will prove a useful asset to any master mechanic or engineer.

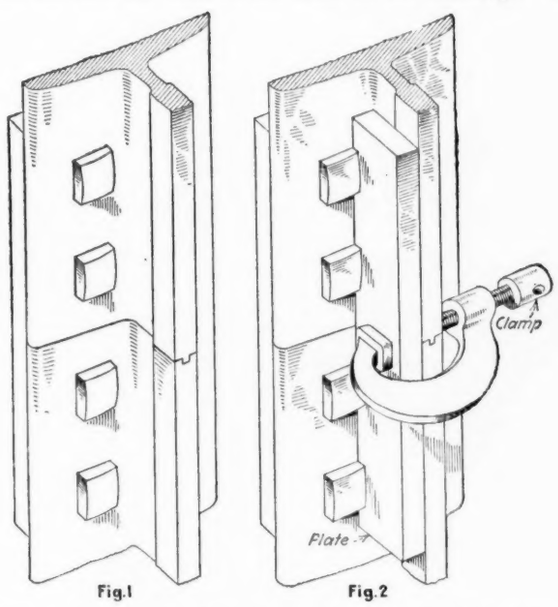
I believe an exchange of such condensed formulas in *Power* would prove interesting and beneficial to its readers. G. F. MCCLAY.

Sherbrooke, Que., Canada.

Making Good Joints in Elevator Guide Rails

WORKING in an elevator hoistway erecting the guide rails is not always the most desirable job. Among other difficulties the work has to be done in more or less cramped quarters. However, after the work is done most mechanics like to have a neat-looking job. If care is used in making up the joints on the guide rails, a large part of making a good-looking job is accomplished. The rails match up with a tongue-and-groove joint in the guide section, as in Fig. 1, and are held by a fishplate and eight bolts.

At these joints the bolt heads should all line up squarely as in the figure. It is not such an easy job to do this on the counterweight rails with two wrenches, when the rails are close to the walls of the buildings. My



Figs. 1 and 2—Section of guide rail showing how the joint bolts are tightened and their head kept in line

method of doing the work is shown in Fig. 2. I take a ½-in. packing plate which just fills the space between the bolt heads and the rail. With the bolts loose the heads are squared and the plate put into place and held there by a C-clamp. This clamp, when tightened, also brings the joint into true alignment. Where tight nuts on the bolts have to be dealt with, this method greatly simplifies the problem, as there is only one wrench to work and the bolts cannot turn. The same method can be applied to the car guide rails, but a thicker packing plate will have to be used. PAUL E. REMP.

Bowmansville, Pa.

COMMENTS FROM READERS

In which those who agree and those who disagree, with either authors or editors, are afforded an opportunity to express their views

Removing Slag from Boiler Tubes

IN THE March 13 issue Richard N. Seldon inquires as to how slag deposits on the bottom row of boiler tubes can be removed without shutting down the boiler.

A method frequently used is to direct a spray of cold water against these tubes. This cold water will chill the slag and cause it to crack and fall off, like a piece of hot glass would break up if it were suddenly chilled by pouring water on it. The question remains open, however, whether this procedure will not be harmful to the boiler in the long run. Especially when the tubes have some scale deposit on the inside, they will be hot, and due to this sudden chilling and resulting contraction, damages may develop.

ERIC PICK.

New York City.

* * * *

Applying Packing to Ends of Motor Bearings

ON PAGE 377 of the Feb. 28 issue H. E. Stafford shows a method of applying a felt washer to a bearing housing to keep in the lubricant and to keep out the dirt, an illustration of which is reproduced herewith.

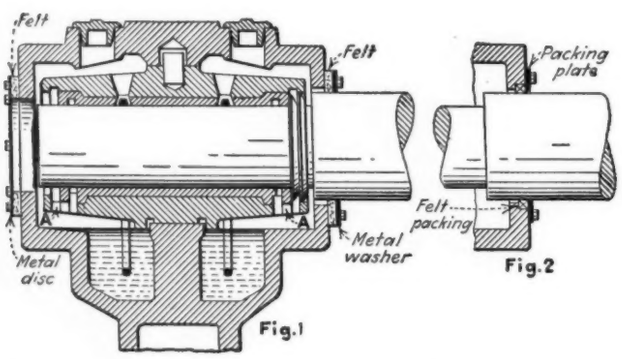


Fig. 1—Felt washer held between plate and bearing. Fig. 2—Packing placed in counterbore

We have tried this method and found it rather unsatisfactory, owing to the following reasons:

There is no metal-to-metal contact between the metal washer and the housing, so the washer screws cannot be turned down hard. The felt is pressed down hard between the washer and the housing, causing it to shred and wear away rapidly and fail to act as a packing ring.

In Fig. 2 is shown the method we use at present, by which the foregoing disadvantages are overcome. The housing is counterbored, forming a packing box about one-quarter-inch square. When filled with felt packing, it will stand up for a long time, sometimes for a year. If an oil-tight, dust-tight or gas-tight housing is specified, this packing chamber can be filled with fibrous metallic packing and good results obtained.

Worcester, Mass. DAVID FLIEGELMAN.

Evaporation or Dissociation

THE criticism from Jay Harris on page 738 of *Power* for April 24, exemplifies better than was anticipated the need of chemists and engineers coming together once in a while. The letter of Mr. Harris would seem to indicate a lesser appreciation of the time factor than presented in the "exposition." Such being the case, the difference of opinion regarding the need of discrimination in words, is evident. However, authority rather than personal opinion is behind the discrimination in the "exposition." The 1927 issue of Webster's Collegiate Dictionary states:

Evaporation—1. Act or process of evaporating. 2. The product or result of evaporating.

Vaporization—Act or process of vaporizing, or state of being vaporized; specif., conversion of water into steam, as in a steam boiler.

Evaporate—1. To cause to evaporate; as the sun evaporates water. 2. To expel moisture from, as by heat, leaving the solid portion; as, to evaporate fruit.

It might be well to add that "where water is boiled" the engineer doesn't ordinarily consider as "a gas" the portion volatilized. This is but one more example of the need of a common language for engineers and chemists.

The subject of dissociation is large. We trust Mr. Harris may know some engineering linguist who can present us with a new slant by some foreign scientist or engineer.

ROBERTSON MATTHEWS.

Detroit, Mich.

* * * *

What Is the Best Practice in Cutting-in Boilers?

WITH reference to the article "Cutting In of Boilers" on page 635, of the April 10 issue, I question the correctness of that part of the paragraph where it says, "It is not correct to bring the pressure to within a few pounds of that in the main, for it is important that the pressures be the same or as near the same as the different gages indicate."

I believe it has been the practice in nearly every boiler plant for many years to bring the pressure of the boiler to be cut in up to within about five pounds before cutting it in. In that way, if there is any water in the line or expansion bends it will flow back into the boiler, as it should, and not out into the main, as stated in the last paragraph. Even if the pressures were equal, the flow of steam would carry the water toward the engine, and if the water was of such volume that the receiver could not handle it or there should be no receiver, as in some old plants, the engine would be damaged.

These instructions may hold true in new and up-to-date plants, where the piping and expansion bends have perfect drainage, but in old plants (and there are yet many) where the drainage is poor or there is none at all, I do not think it is good practice to wait until the pressure in the boiler that has been out of service has come

up to full operating pressure before cutting it in. And I doubt if it is a safe practice even in new plants having proper drains, as they may not have been opened between the time of cutting out and cutting in of the boiler due to the carelessness of an operator. FRED E. BOND.

Louisville, Ky.

* * * *

Combustion Control Formula

THE series of articles that recently appeared in *Power* on combustion control formulas, by Dr. E. A. Uehling are most interesting, but it does not appear to me that the reasoning is always clear or that it is based on the latest engineering practice. For the specific case in mind reference may be made to the article on page 971 of the Dec. 20, 1927, issue. In order to establish the unreliability of coal heat values as determined by sampling the coal and making the usual calorimeter tests, etc., he cites the classical series of boiler tests made by Doctor Jacobus at Detroit in 1911—seventeen years ago. Doctor Uehling reproduces in his Table II the B.t.u. determinations made on fourteen separate coal samples by two laboratories in connection with these tests. Then, referring to this table, he goes on to say: "The comparison shows that the variation in heating value between duplicate samples ranges from one to 929 B.t.u. or from zero to 6.11 per cent, an average of nearly 3 per cent. Table II [in the Uehling article] demonstrates the difficulty involved in securing a true average sample from a large quantity of coal, even when the greatest care is exercised." Doctor Uehling apparently seeks to leave the impression that, because these tests, as a whole, stand out in engineering history, the means used for sampling and getting the heat value of the coal were also of classical elegance. Then he shows us the variability of the results!

I should like to invite attention to a second series of high-grade tests made, after ten years' more experience, on the same boilers at Detroit and reported by P. W. Thompson in the A.S.M.E. Proceedings of 1922. Table I herewith is taken from this report, except for the two right-hand columns which I have added.

TABLE I—COMPARISON OF COAL ANALYSES

Analyses are for dry coal and are made on duplicate samples. Samples Nos. 106 116, and 126 are Shipper A coal; sample No. 138, Shipper B coal.

Test No.	Sample No.	Analysis Made By	Proximate Analysis: Fixed Carbon	Volatile Matter	Ash	B.t.u.	B.t.u. Variation In B.t.u.	B.t.u. Variation In per Cent
4	106	D	55.30	33.50	11.20	13,133*	—164	1.23
		S	54.14	34.93	10.93	13,297	0	0
		P	54.96	34.40	10.64	13,062	—235	1.77
9	116	D	55.15	34.55	10.30	13,365*	+ 81	0.61
		S	53.88	36.08	10.04	13,284	0	0
		P	54.38	35.34	10.28	13,150	—134	1.01
14	126	D	54.90	34.85	10.25	13,352*	+ 52	0.39
		S	53.40	35.87	10.73	13,298	0	0
		P	55.28	34.03	10.69	13,146	—152	1.14
24	138	D	58.75	33.50	7.75	13,927*	+407	3.01
		S	55.54	35.65	8.81	13,520	0	0
		P	57.11	33.93	8.96	13,584	+ 64	0.47
		Average.....				13,345	107	0.80

*Values used in computations. D, The Detroit Edison Company; S, Solvay Process Company; P, Pittsburgh Testing Laboratory.

We note first that three laboratories have been consulted instead of two, as in the Jacobus tests. Probably each laboratory "shot" more samples. The practice of the Bureau of Mines today is, I believe, to run five tests simultaneously on each sample and give the average as the official figure. The average of the last column in the table shows that the average variation is 0.8 per cent, or less than one-third what it was in the Jacobus tests of 1911, as shown in Doctor Uehling's Table II. Probably a series of tests conducted in 1928 by, say, Doctor Jacobus, would show a still further improvement. Table II is for comparison with Table III in the Uehling article.

TABLE II—COMPARISON OF COAL ANALYSES

Test No.	C	H_2	O_2	N_2	S_2	Ash	B.t.u. per P. C. Unit	Variation from Standard: B.t.u.	Variation from Standard: Per Cent
4	73.55	4.44	8.76	1.30	0.75	11.20	17,420	380	2.11
4	70.57	5.15	10.93	1.38	1.04	10.93	17,920	20	0.11
4	73.67	4.72	8.44	1.37	1.16	10.64	17,685	215	1.20
9	74.59	4.82	7.85	1.54	0.90	10.30	17,700	200	1.12
9	74.91	5.13	7.83	1.14	0.98	10.04	18,040	140	0.78
9	74.10	4.98	8.09	1.44	1.11	10.28	17,920	20	0.11
14	75.12	4.72	7.45	1.32	1.14	10.25	17,720	180	1.00
14	71.94	5.30	9.26	1.44	1.33	10.73	18,285	385	2.15
14	72.48	4.98	9.10	1.43	1.32	10.69	18,020	120	0.67
24	75.83	5.08	9.06	1.25	1.03	7.75	17,935	35	0.20
24	75.88	5.90	7.01	1.26	1.14	8.81	18,700	800	4.46
24	77.63	5.19	5.56	1.41	1.25	8.96	18,180	280	1.56
						Averages.....	17,969	68.7	0.38

It will be noted that the variation in heat value of the pound carbon unit as shown in Table II is greater than for the pound of coal as shown in Table I. The pound carbon unit ranges from minus 2.11 per cent to plus 4.46 per cent, while the pound of coal varies from 0.39 per cent to 3.01 per cent. This is just the reverse of the condition brought out by the figures cited in Doctor Uehling's article. The fact that the average algebraic variation from the standard of 17,900 B.t.u. is only 0.38 per cent appears to me to mean nothing so far as applied to the accuracy of any given test, because in any case the amount of coal corresponding to the pound carbon unit still has to be determined. It is in this determination in the case of Eastern bituminous coal that the major variation is found.

Now, I do not think these comparisons mean a great deal. Even if they were consistent (which they are not) they would not be conclusive. I have simply given Tables I and II to bear out this view. Further, all these tables relate to Eastern bituminous coal. It is well-known this coal yields much more consistent results with Dulong's formula—or the variation suggested by Doctor Uehling—than do any of the Western coals. The difficulty of making a proper ash determination—and therefore a proper ultimate analysis—of Illinois coal on account of the presence of calcium carbonate, etc., is well known.

Setting aside the question of the correctness of 17,900 B.t.u. as the heating value of the pound carbon unit and limiting ourselves to the *practically* correct value for the use of the "average" power plant, I fail to see where any benefit is received. I see mainly more complication and more expense in getting a usable heat value for the coal. To determine the carbon is about as difficult and expensive as to determine the B.t.u. directly. So it seems to me that it remains to be demonstrated that the pound carbon unit is as reliable, as simple and as cheap to use as the present method even when applied to Eastern coal. Or, assuming this could be proved, the real test would appear to come when the method is applied to Mid-Western coal.

Less than a year after the Thompson test at Detroit Edison Company, C. F. Hirshfeld of that company (A.S.M.E. Transactions, 1922, page 90), in speaking for himself and his associates on the accuracy of boiler tests, made the following statement, with which many of us from personal experience can agree: "The statement that much depends on the method of coal sampling cannot be over-emphasized. We have tried simultaneously three

independent methods of sampling, each carefully designed and executed to yield an average sample, and have found the resulting heating values to check well within plus or minus 0.5 per cent. . . . We recognize that if sampling is not done with great care, errors as large as 3 per cent or even more, may readily be introduced, *provided there is at least that much variation in the character of the coal being burned.*" [The italics are mine.]

Obviously, with a perfectly homogeneous material the sampling would cease to be of consequence. But in practice the heat value of different portions of a car of coal may vary greatly. M. B. Smith, in his paper on factors in the purchase of coal (given before the A.S.M.E. fuels session in St. Louis in October), said: "The buyer should know that 1¼-in. slack as a rule contains 25 per cent less fuel value than the 2-in. slack.' Of course Mr. Smith was talking about some particular field, probably even some particular group of mines, and the phrase "as a rule" is not to be taken literally. To go to the other extreme, many Eastern bituminous and semi-bituminous coals will not vary one-tenth this amount, in fact less than 2 per cent. The actual figure for any mine depends considerably on the ease of separating the coal from the surrounding strata.

The A.S.M.E. test code for solid fuels and the personnel of the committee back of it is eloquent testimony of the great importance now attached to proper and adequate sampling of coal as well as to other features of heat value determination. And the accuracy of the results when the best modern practice is followed is, I believe, on a higher plane than that indicated by Doctor Uehling, who appears to pick out a weak spot of boiler testing in the year 1911 and apply it to the year 1928.

Dayton, Ohio. GUY B. RANDALL.

* * * *

Horizontal Return-Tubular Boilers

THE article on "Horizontal Return-Tubular Boilers," by D. D. Eames, in the Feb. 14 issue, contains a great deal of interesting information, but there is one statement that is so important, and, in my opinion, misleading, that I would like to take exception to it.

Mr. Eames says that "the amount of heat available to a heat absorbing surface from an incandescent fuel bed varies inversely as the square of the intervening distance."

It was no doubt upon some such assumption as this that the now discredited practice of low boiler settings was based.

As a matter of fact the law of inverse squares applies only under conditions that seldom occur in practice and never in a boiler furnace.

If we consider a single point source of radiant energy, such as an incandescent lamp approximately is, provided that no light is reflected from the walls of the room, the intensity of illumination upon the floor or working plane will be nearly inversely as the square of its distance from the lamp, but immediately we introduce other lamps this is no longer true.

When we install a number of lamps, their rays overlap, and unless the hanging height is excessive, it is not usual to take account of it when figuring the intensity of illumination on the working plane.

The nature of an incandescent coal bed is such that it provides many thousands of point sources per square foot; in fact, it is equivalent to a mat illuminating surface which does not act in accordance with the inverse square rule at all.

I am not calling attention to the foregoing merely for the purpose of discussing an academic point, but because in this day, when so much consideration is being given to furnace heights, any such assumption as that made by Mr. Eames could quite readily lead to unsatisfactory results.

If we look at the matter carefully, we shall see that all the radiant heat produced by the coal bed must either reach the heating surfaces of the boiler, be radiated by the settings, or carried away by the flue gases after reflection from other surfaces; and in considering the height of the settings it would appear that the only source of heat waste on account of high settings would be due to greater radiation to the atmosphere, which in the case of well-built settings would be negligible, and within reasonable limits far more than offset by the better combustion conditions. J. O. G. GIBBONS.

Newark, N. J.

ANSWERS to "What Do You Know"

The questions are on page 855

Ans. 1—Boilers are rated on the basis of 3.45 lb. of water from water at 212 deg. F. into steam at 212 deg. F. per square foot. A better method is to have the boiler capacity on the basis of the B.t.u. absorbed per square foot of heating surface.

Ans. 2—All the electrical energy is converted into heat losses in the motor and shafting and into mechanical work used in the machinery processes. All this work reappears as frictional heat developed in the tearing away of metal by the tools. It can be stated then that all the electrical energy is used to heat the shop.

Ans. 3—If cooled back to 60 deg. F. only, the work of compression has been removed and the air will have its original heat content.

Ans. 4—This is a chart made up of four sections of crossed lines of standard widths. The smoke from a stack is observed against a clear sky and its color compared to the effect upon the eye of one of these gratings of the Ringlemann's charts when the chart is placed 50 ft. from the eye.

Ans. 5—This system is used on the Bessemer and upon the Atlas-Imperial Diesel engines.

Ans. 6—The largest have been rated at 3,750 brake-horsepower.

Ans. 7—Yes. Ice can and does change directly into water vapor; this is called sublimation.

Ans. 8—At the critical point the water and steam have equal densities, a steam bubble occupies no greater volume than the water from which it was formed. There need, then, be no disengaging surfaces, permitting the drums to be disposed with. This is a safety and manufacturing advantage.

Ans. 9—Cork contains a large number of small air cells; these reduce the heat-transfer rate, as they interpose an obstacle to the heat flow.

Ans. 10—The railroads, although if house heating be deemed an industry, more coal is used in this.

PLANT EQUIPMENT NEWS

New and improved equipment in power and industrial plant fields, and new applications of existing equipment

Underfeed Stoker for Heating Boilers

THE illustration shows the automatic stoker (known as the Modern Coal Burner) developed by the Modern Burner Company, 1601 McCormick Building, Chicago, Ill.,

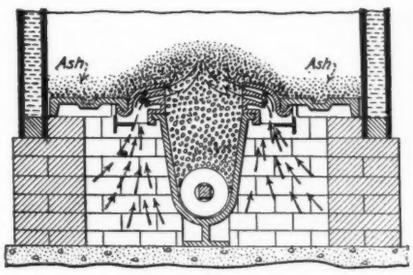


Fig. 1—Cross-section of retort showing tuyere arrangement

for use with the steam or hot-water boilers in sizes from 150 to 600 sq.ft. of heating surface. The stoker is designed especially to burn low-priced coals, such as Illinois and Indiana screenings.

The burner operates on the underfeed principle. Coal from the hopper is fed into the retort within the furnace by means of a screw which is so designed as to give uniform feed from the hopper and also to distribute the coal and force it upward in the furnace. The air for combustion is admitted through the tuyeres at the top of the retort (see Fig. 1). The volatile gases are distilled off, and the coke formed below the incandescent part of the fuel bed. This tends to give smokeless combustion.

The unit is automatically controlled, both the coal feed and forced draft being cut in and out as required to maintain the desired steam pressure.

Fig. 2 shows a typical stoker and boiler installation. The stoker is, however, adaptable to the various types of heating boilers.

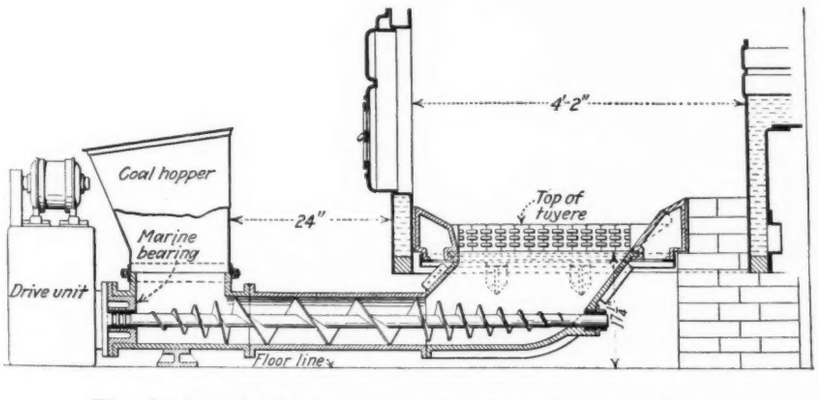


Fig. 2—Longitudinal cross-section through retort showing feeding mechanism

New Clutch Uses Spring As Friction Member

A SPRING clutch for which the manufacturers claim wide application in power-transmission equipment, has been introduced by the L.G.S. Manufacturing Company, Indianapolis, Ind. In its simplest form the clutch consists of a steel coil spring mounted inside of two adjacent and abutting cylindrical bores. When one of the cylindrical members revolves with respect to the other in a direction that would tend to expand the spring, friction between the spring and both cylindrical members builds up and gives clutching action. If the rotation is in the opposite direction, the tendency is to coil the spring, and friction between the spring and the rotating members becomes slight and the clutch disengages. The mechanism hence acts as a ratchet.

Referring to Fig. 1, *A* represents the spring, *B* and *C* are respectively the two cylindrical members, *D* represents a sliding pin, moved by means of a collar which engages a yoke on the mechanism. The spring *A* is in this case slightly smaller than the bore of *B* and *C*. One end of the spring is attached to *B*, while the other end engages *D* when the latter

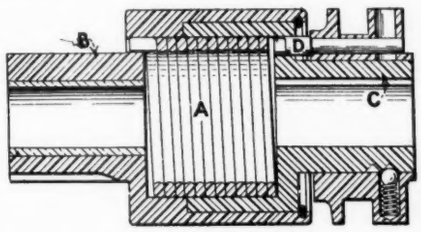


Fig. 1—Spring "A" is friction member between parts "B" and "C"

is in its extreme left position. This causes immediate expansion of the spring and results in the clutch taking hold.

One of the many applications of this clutch is shown in Fig. 2. Here the device is built into a pulley to serve as a centrifugal clutch. A part comparable to pin *D* in Fig. 1 is actuated by centrifugal force at some predetermined speed. By use of the clutch an electric motor driving a piece of equipment may be permitted to attain full speed before the load is put on, thus enabling a motor smaller than would usually be required, to be used. In case of an overload the clutch automatically disengages, thus protecting the motor. This same device may be used as an unloader for pumps and air compressors.

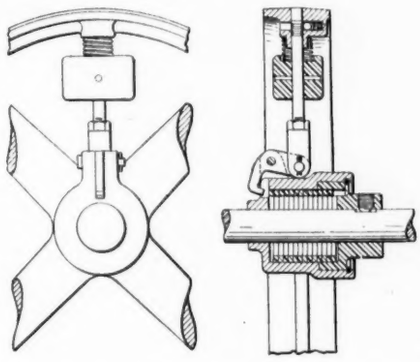


Fig. 2—Clutch applied to pulley

Sterling Company Builds Large Gasoline Engines

A NUMBER of large-bore, high-speed and high-duty gasoline engines are being put out by the Sterling Engine Company, Buffalo, N. Y. These are six- and eight-cylinder units with 8-in. bore, 9-in. stroke, developing in a six-cylinder model 425 hp. at 1,200 revolutions and 565 hp. in the eight-cylinder unit at the same speed.

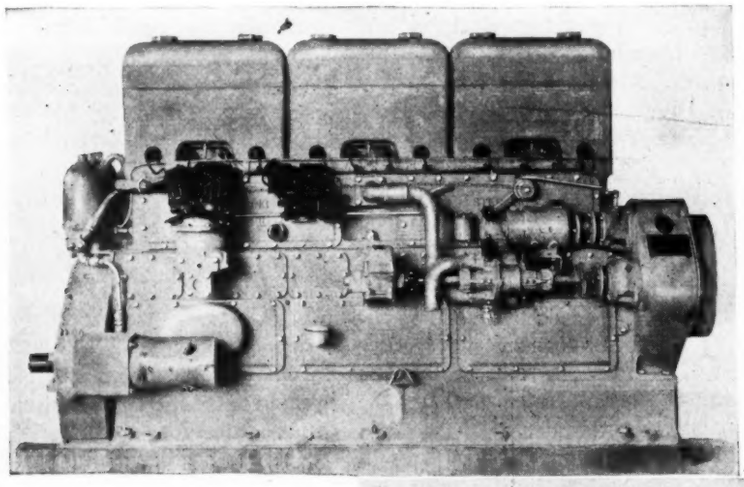


Fig. 1—Six-cylinder engine develops 425 hp. at 1,200 r.p.m.

The new engines are built with iron crankcases and weigh about fifteen pounds per horsepower, excluding batteries but including electric starters and generators. The crankshaft is 4-in., with extra long bearings, having a total effective length of $22\frac{1}{4}$ in. in the six-cylinder model.

The cylinder casting is essentially a long water-jacket in which the cylinder walls are inserted. The cylinders project down into the upper crankcase so that the piston is guided the full length of the stroke. The cylinder heads are made in pairs and can be detached without disconnecting the exhaust line or the fuel piping or manifolds. The combustion chamber is fully machined, giving a smooth surface. Connecting rods are 18 in. long on centers, with main bearings 4 in. in diameter and $3\frac{3}{8}$ in. long. Oil is carried under pressure up to the piston pins, which are tubular, cut from solid nickel-chromium steel two inches in diameter.

Dual valves are used in the head. They are operated from the camshaft by roller-type push rods, and any tendency for side thrust has been overcome by interposing a member between the rocker arm and the valve stem.

A full force-feed oiling system is employed to all main, connecting-rod and camshaft bearings and to the piston pins. The oil is forced through a cooler attached to the side of the cylinder block and also strained through oil purifiers.

The cooling system consists of a bronze water pump with aluminum bronze gears. The water is pumped first to the cooling header on the side of the cylinder block, where it functions to cool the oil, then into the cylinder block and up through internal passages, protected by brass ferrules set in cork (to prevent electrolysis). The inlet and the exhaust manifolds are integral. The exhaust header is water-jacketed, but hot spots are provided just above the carburetors, to assist in gasifying the fuel.

The ignition can be provided for either 12 or 32 volts and consists of four distributors, each firing four spark plugs per cylinder, two on each side. All the plugs are in action, but in the event of one or more systems being down, the remainder would operate the engine. Three carburetors are used for the six-cylinder engine and four for the eight-cylinder engine.

The fuel efficiency, on three-quarter to full load conditions, is given as 0.65 lb. per brake-horsepower per hour.

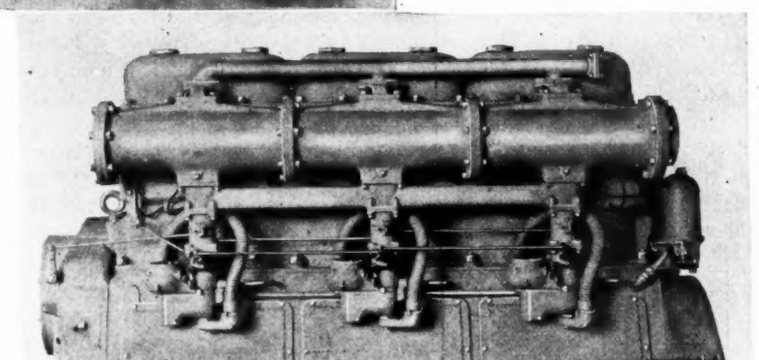


Fig. 2—View of engine showing carburetor and manifold arrangement

Esso Refractory Gun

ABILITY to mix its own material mechanically, operate on air pressures as low as 30 lb., be operated by one man, and to spray twenty gallons with one filling, are some of the features of the Esso gun for spraying refractories, recently brought out by the S. Obermayer Company, of Chicago, Ill.

The nozzles are fed by a twenty-gallon brazed tank equipped with an adjustable reducing valve suitable for the air pressure with which the gun is to be used. Two interchangeable nozzles—one short nozzle for places easily reached and a long one for more difficult locations—are furnished. Air and the material being sprayed reach

the nozzles through two 25-ft. lengths of hose attached to the storage tank, and both air and the material are regulated at the gun head by separate valves. By varying the amount of air and material, the density of the spray is readily controlled.

Machine complete with hose and extra nozzle

When through spraying, the material left in the hose can be forced back into the tank by releasing the pressure on the tank with the bleeder valve and bypassing the air pressure into the material hose by placing a finger over the nozzle.

The left-over material can be stored in the tank until needed, and then remixed ready for application right in the tank. The mechanical mixing is done in the tank by air. To do this the air line is connected to the material outlet, the bleeder valve opened and air admitted through the valve at the base of the tank. Both fresh and left-over materials are mixed in this way.

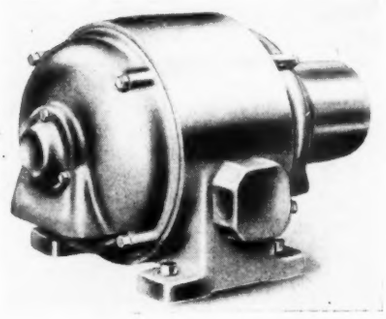
A large funnel with a removable 16-mesh screen is supplied for charging the machine. It is screwed into the tank at the top in place of the plug *A*. This plug is attached to a pipe that extends down into the tank, so that the amount of water or material in the tank can be readily measured. Two arms project out sidewise from the plug, and these serve as handles when the gun is to be moved. To facilitate the moving, two small wheels are attached to the base of the tank in such a way that they carry the tank when it is tilted, but the wheels are out of the way and the tank sits firmly on its base when placed in an upright position.

All the fittings and the nozzles are made of brass, and the steel tank has a coating of brass to protect it. A pressure gage and an adjustable safety valve are included in the standard equipment and are placed on top of the tank.

Sterling Cros-Line Totally Inclosed Motors

IN THE new line of totally inclosed motors recently brought out by the Sterling Electric Motors, Inc., Los Angeles, Calif., interchangeable voltage connections are provided in the terminal box so that the motor is readily connected for 220 or 440 volts as desired. The motors are designed for across-the-line starting by means of push-button control.

They are mounted on either ball or roller bearings, as desired, in sizes from $\frac{1}{4}$ to 30 hp. for three-phase applications. Single-phase machines are built in sizes from 1 to 5 hp. and for various speeds. The motors are one-piece frame construction with cast rotors and are designed for low-temperature rise and with generous overload capacity. They can be used as totally inclosed, totally inclosed pipe ventilated, or totally inclosed ventilated.



Cros-line totally inclosed ventilated motor

New Automatic Starters for Direct-Current Motors

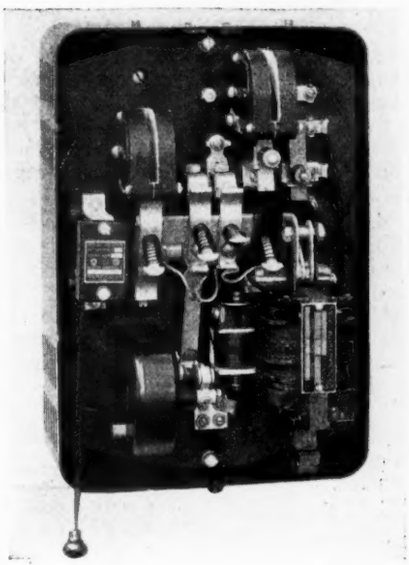
A COMPLETE new line of direct-current motor starters for general purpose applications has been introduced by the General Electric Company. These starters are designed to provide definite-time acceleration for constant- and adjustable-speed motors, and are divided into five types, one of which is shown in the figure. One of the principal advantages of the new design is the fact that, despite a reduction in size, the number of accelerating points has been increased.

One type is for constant-speed general purpose applications. A second type is the same as the first with the addition of dynamic braking. A third type is for adjustable-speed motors with dynamic braking and full-field features. The fourth is a constant-speed type, reversing, with dynamic braking. A fifth type is for adjustable-speed, reversing, with dynamic braking and full-field features.

The inclosing case cover hooks over two pins at the top of the box, the bottom being held by a screw. This is in accordance with the Underwriters' requirements, which state that, if the cover is removed, it must be held in place by a device which requires tools to open it. This this eliminates thumbnuts, latches, or other fastenings.

On those starters provided with dynamic braking a small relay is used to prevent the solenoid from being re-energized until the motor has come to rest. The contacts of this relay are connected in the pick-up circuit.

Thermal overload protection is provided by means of single-coil re-



Automatic starter for adjustable-speed motors

lays designed for overload protection and having a thermal capacity to stand high inrush currents. These relays operate only in extreme conditions and serve as a warning to the operator that the motor or wiring requires attention.

The Hydraulic Handling of Ashes*

By Arthur Mellor Quinn

Engineer, Allen-Sherman-Hoff Co.

CERTAIN outstanding plants prior to 1923 installed hydraulic methods of ash handling. This was done, the author believes, in most cases with boilers equipped with underfeed stokers having a grinder ash discharge, or with chain-grate stokers where no large clinkers were anticipated. The simplicity of the arrangement, absence of moving parts, elimination of labor, and the fact that the ashes were not handled loose with the attendant dust, dirt and fog, became apparent at once and offset disadvantages which came up. Briefly, the most serious of these disadvantages was as follows:

1. The stokers discharged ashes continuously, and it was necessary to pump water continuously. This resulted in high pumping cost—from 20 to 40 kw.-hr. per ton of ash moved were average figures.

2. The water channels of sluiceways were pitched, which resulted in the necessity of setting the stokers very high above the ash basement, and consequently in high building expense.

3. In order to minimize the pitch of the sluiceway, and therefore the building height, water velocity was kept at a minimum to carry the ash safely. As a result the ash apparently half slid, half rolled along the bottom, and wear on the sluiceway liners was high.

4. The sluiceway started at one end of the boiler house and continued to the other; further, it had to run continuously. Repairs, therefore, could be made only by handling the ash discharge from all the upstream boilers by other means (usually temporary, and as such, crude).

5. It was found with the sluiceway pitches ordinarily employed that clinkers of only limited size and density could be handled.

6. If the sluice dammed at the downstream end, its operation was instantly destroyed for all upstream boilers, and as they depend upon the ashes being taken away as rapidly as discharged, the cumulative results were serious.

Designs Employed in Modern Installations

Designers in the last five years have been continuously working to retain the inherent advantages of these earlier installations and eliminate these six major disadvantages. The designs employed by many modern installations are therefore as listed below:

1. To reduce the cost of pumping continuously, ash hoppers having from 8 to 24 hours ash storage between the stoker and the sluiceway are commonly employed.

2. To overcome the necessity of pitching the sluiceway, water is introduced into it through nozzles at very high velocity by pumping it at high pressure (50 to 100 lb.) and then, as the velocity drops along the sluiceway, introducing additional "boster" water. It was found that velocities of from 50 to 100 ft. per sec. could readily be maintained in a horizontal sluiceway for long distances (200 to 500 ft.).

3. Whereas, ashes dropping into water moving at 10 to 12 ft. per sec. slide or roll along the bottom, it was found that with velocities of from 50 to 100 ft. per sec. the ash did not sink, but rather rode on top of the stream; abrasion of the sluiceway liners was thereby virtually eliminated.

4. As there was an ash storage of from 8 to 24 hours between the stokers and the sluiceway, which could be discharged in as many minutes, there remained some 23 hours per day available for repairs, should they ever be necessary.

5. As the power available in a stream of water is a direct function of the water quantity and a function of the square of the water velocity, modern plants have almost eliminated the possibility of large, dense clinker or arch tile or the like failing to move along the sluiceway. A modern sluiceway will readily carry a dense clinker weighing 50 to 75 lb. or, to say it another way, will carry any stoker-refuse material passing 12-in. square grids.

6. Even should a modern sluice dam up (owing to loss of water from the pumps or the like), operation of the plant is not seriously affected, as ashes will merely continue to accumulate in the ash hoppers until the water pressure has been re-established and the dam broken up and discharged, when the usual method of ash discharge will be continued.

A serious difficulty developed in storing ashes so that sluiceways might be intermittently operated. The original idea was that ash gates would control the flow of the ashes from the hopper to the sluice. However, it soon became apparent that it was virtually impossible by simply opening the gate which controlled an accumulation of several tons above, not to overload instantaneously the carrying capacity of the sluice below. It was therefore necessary to develop a positive means of controlling the instantaneous flow of ashes from the hopper above in proportion to the instantaneous carrying capacity of the sluice. Two general schemes have been successfully employed.

The first consisted in dropping the ashes into a mechanical feeder provided with rolls that would feed directly in proportion to the speed at which they were driven.

Another simple and positive scheme consists in eliminating the ash gates altogether and allowing the ashes from the stoker to drop onto slightly sloping plates forming the bottom of the ash hopper. When the hopper is full, water jets (fed from the same source of water supply as that feeding the main-sluiceway carrying nozzles) undermine the accumulated ashes, both ashes and water flowing into the sluiceway.

This scheme can be used only where no large proportion of the ash will contain clinkers individually exceeding 50 to 75 lb. in weight. Usually, it is not applicable to underfeed stokers using dump-plate ash discharge. Mechanical feed (such as grinders) should be employed under this condition.

Handling Ash from Pulverized-Fuel Furnaces

Modern hydraulic ash handling is particularly applicable to ash from pulverized-fuel furnaces. It has been found that on the average about 25 per cent of the total ash in the fuel where powdered coal is employed is collected in the ashpit proper. Another 15 to 20 per cent is collected from the second pass of the boiler, from hoppers beneath the economizers or air heaters, from flues, and from the base of the stacks.

A horizontal sluiceway may thus readily be used to collect dust from many sources through comparatively small pipes run almost at will. By carrying this dust mixed with water and virtually as a fluid, none of the problems of flow angles along various substances enter—all of which results in amazing simplicity of design.

*From paper presented at the First National Meeting of the A.S.M.E. Materials Handling Division, Philadelphia, Pa., April 23, 1928.

TEAMWORK FOR PROFITS
in a Buyer's Market

E. J. Mehren, vice-president Mc-Graw-Hill Publishing Company, before U. S. Chamber of Commerce urges that body to create sentiment for less volume, fixed profits, and open bids when price concessions are asked

PROFITS have been shrinking. The buyers have the upper hand and are pressing their advantage. Can teamwork help us?

Time forbids a discussion of all the influences that lower and destroy profits. There is a long chain of them. It starts with overcapacity and includes the craze for volume, overproduction, obsolete equipment and consequently high manufacturing costs, intense competition, a mobile and even fickle buying public, high selling costs, price profiteering by buyers and price cutting by sellers.

It is just as well that all these influences cannot be discussed, for action cannot be taken quickly on all of them. Many yield fruit only to long study. But there are two in which a revolution is needed and needed at once. We need, first, to supplant the craze for volume by a reasonable passion for profits, and second, to eliminate buyers' profiteering, and the accompanying price cowardice.

Production Volume Accorded Too Much Weight

At the very root of our difficulties lies the craze for volume. We would sooner have volume than profits. A full factory and red ink seems as popular as 70 per cent operation and plenty of black. Swollen sales expense to get the last 20 per cent of business. Ruinous prices to fill up the factory. The goal is volume, not profits.

We fail to realize that the law of diminishing returns cannot be flouted. The nearer we get to perfect performance the smaller the gain for a given effort. It cannot be escaped. The top business costs more than it is worth and only injects an undesirable color scheme into our balance sheets. Some men refuse to acknowledge this law and, even after they land in the bankruptcy courts, fail to realize that it is the expenditure of two dollars to get every dollar of top sales that "put them on the blink."

Here is an opportunity for beneficent propaganda, for spreading a fire of sound business doctrine the country over; for creating through trade associations and chambers of commerce a country-wide sentiment for restoration of fair profits as our business goal. Let business men be business men—and no one is a business man who, in the craze for volume, takes less than a savings bank return on his capital, who swaps dollar for dollar, or worse than all, pays for the privilege of being in business.

Price inquiry by buyers is natural and proper, salutary to buyer and seller alike. But price clubbing, using one bid and then another, and back again two or three times, is guerilla warfare.

Sometimes the buyer descends—or ascends—to even slicker methods. Three salesmen recently called on a prospective buyer to whom they had previously made bids. That night they met and discovered that each one had been shown a different blueprint by the prospective buyer and that each seller stood high on the sheet he had seen.

But the buyer can pursue his tactics only because the seller lacks price courage. Often the seller offers price concessions before the prospect has had an opportunity to ask for them. Such is the hunger for business. If the buyer is as he is, the sellers have helped to make him so. They are reaping the whirlwind that they have sown.

What are we going to do about it? Here are two suggestions:

First. Let all sellers insist on seeing all submitted prices when price concessions are demanded. The purchaser who is "on the square" will show them. Business shouldn't be stud poker with all the cards turned down.

Second. Let all sellers determine not to cut a price or bid once it has been submitted. Do all figuring in advance. Then stick by the price.

Here is where teamwork enters. You are men of influence and that means centers of influence. If you five hundred men will "sell" these proposals to your trade associations and chambers of commerce, price profiteering and price cutting can be largely wiped out in a month's time.

Seller Lacks Price Courage Apply the Golden Rule

With these words we should be finished with this particular topic. But we're not. You, Mr. Manufacturer, are an outraged seller. You are not human if you have not chafed under the conditions. But has it occurred to you that you, too, are a buyer? Is your purchasing agent a profiteer and a price clubber? Are you practicing on others what you condemn when practiced on you?

"I never thought of that," manufacturers have replied to that question. And some of them have promptly added, "I'll put a stop to it at once."

Put your own purchasing right and the reformation will have been started. You can, then, with clean hands, carry this propaganda into your own circles of influence.

These proposals do not run counter to either economic or statute law. Competition will not be done away with. There will be no collusion. The process proposed would be educational. The end result would be that the pencil sharpening would be done only once—and that before the price is submitted and with an eye on costs.

What Happened to Coal*

LET us study the record of consumption of fuel by public-utility power plants. According to the computation given out by the Bureau of Mines, it required in 1919 an average consumption of $3\frac{7}{10}$ lb. of coal to generate a kilowatt-hour of electricity; by 1927 this amount had been reduced to an average of 1.83 lb. of coal, while individual power plants had reduced the consumption to as low as nine-tenths of a pound per kilowatt-hour. Comparing the average for 1927 with that for 1919 we find a reduction of no less than $42\frac{8}{10}$ per cent in the rate of coal consumption for this purpose. If the quantity of electricity generated by coal in 1927 had required coal consumption at the 1919 rate, the additional tonnage of coal would have been over 31,000,000.

A still better and more pertinent illustration of the effect of these economies in consumption on the demand for bituminous coal is furnished by the records of the railroads themselves. In 1920 it required 197 lb. of coal to move one mile, 1,000 tons of freight and equipment, exclusive of locomotive and tender; while by 1927, through improved devices and methods of combustion, the amount required had been reduced to 148 lb. This decline in fuel consumption amounted to 25 per cent. If the conditions of coal combustion existing in 1920 had prevailed in 1927, the railroad transportation business of the latter year would have required the consumption of over 42,000,000 tons of coal in excess of the amount consumed.

By adding this amount to the savings of public utility power plants shown above we find that in these two important uses alone economies have been introduced which have effected a saving in coal consumption to the amount of 73,000,000 tons a year.

According to the latest figures issued by the United States Geological Survey the developed water power in this country on Jan. 1, 1928, had a capacity of 12,296,000 hp. To develop the same amount of power by the use of bituminous coal would require the consumption of at least 31,000,000 tons of coal.

The actual consumption of oil as fuel in 1927 was 437,067,000 bbl. At the rate of four barrels to the ton that amount of fuel oil replaced 109,267,000 tons of coal. If we add to that the 31,000,000 tons displaced through the utilization of water power sites, we have an aggregate loss of coal tonnage in one year, through the use of these two substitutes, of 140,267,000 tons.

*From a recent paper by E. C. Mahon, President, National Coal Association.

NEWS OF THE FIELD

The editors will welcome the co-operation of readers in reporting interesting happenings, personal or otherwise

Utility Investigation Shows Publicity Activity in Schools

The investigation of the publicity activities of the public utilities by the Federal Trade Commission has revealed some surprising practices. The Commission, having finished for the time being introducing testimony and documentary evidence concerning the joint committee of the National Electric Light Association and the American Gas Association, is directing its attention to a few of the 38 state utility publicity organizations.

Testimony of Clarence G. Willard, secretary of the Connecticut Committee on Public Service Information, disclosed that the committee issues a pamphlet on public utilities which is circulated among the high schools of the state and used in many classes in civics. Attention was drawn to a statement appearing in the pamphlet to the effect that those cities which own their own public utilities have a higher cost of living than those with private plants. Mr. Healy, attorney for the commission, remarked that this and other matter in the pamphlet was intended to show the alleged failure of municipal utility enterprise.

Testifying further, Mr. Willard said that the committee had never contributed to a political campaign, but tries to confine itself to the distribution of news to newspapers and schools all of which he admitted to be favorable to the public utilities.

The committee membership Mr. Willard said comprised electric light, gas, street railways, telephone and water companies, and operated on a budget of $15,000 drawn from the member companies.

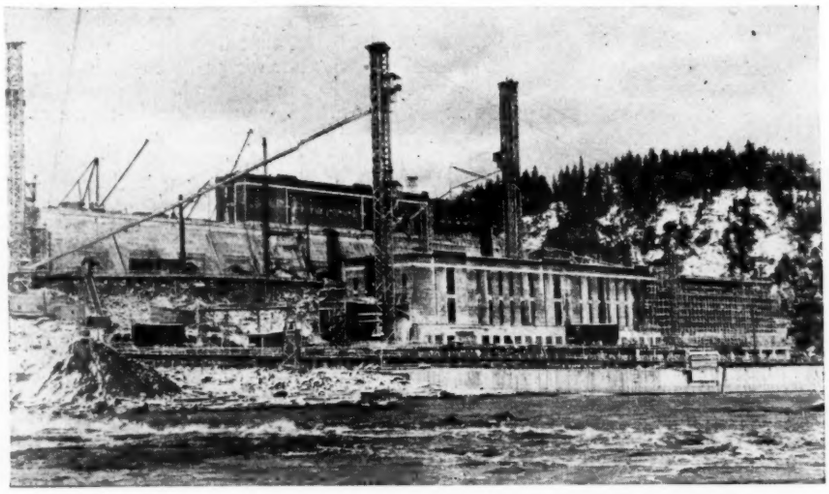
Publicity Activities in Pennsylvania

In a general summary of the editorial and public relation activities of the public utility industries in Pennsylvania, Major Richardson, now director of information of the joint committee of the National Utilities Associations, stated that public utility courses had been established at the University of Pennsylvania and Temple University through the agency of the Pennsylvania Public Service Information Committee. The summary also showed that information and news services were distributed regularly by this organization to newspapers and schools of the state.

Major Richardson testified that Dr. S. S. Wyer, an educator, had been engaged to conduct a survey of textbooks in use in the state schools with a view to the elimination of books or matter therein objectionable to the utility interests. Evidence submitted showed that this survey had been completed and a method proposed for getting the schools of the state to use only the approved books. Major Richardson, however, testified that he thought nothing was done about the matter. Other letters and testimony showed the close attention paid to the contents and use of texts in Pennsylvania schools.

Examination of Allyn B. Tunis, secretary of the Public Utilities Association of Virginia, disclosed that the new Virginia Committee on Public Utility Information serves as a clearing house for educational information in regard to the Virginia public-service companies, and is in line with a nation-wide movement that has extended to 30 states. This committee or association had not, according to Mr. Tunis, done anything regarding school textbooks, nor did it distribute pamphlets to the schools.

Paugan, Quebec, Hydro-Electric Plant in Operation This Summer



Paugan power station on the Gatineau River, designed for eight units rated at 34,000 hp. each

THE first generator in the Paugan, Quebec, hydro-electric plant of Gatineau Power Company, a subsidiary of International Paper Company, will be in operation and delivering electric energy in June. The plant is on the Gatineau River, 33 miles north of the city of Ottawa, the capital of Canada, and is designed for eight generators of 34,000 hp. each, of which six units will be installed initially.

The dam which has been built below the falls will back the river up a distance of 30 miles, submerging nine falls and rapids and creating a head of 136 ft. The power will be generated at 6,600 volts and stepped up to 220,000 volts for transmission.

Paugan development is one of three which the Gatineau Power Company has on the Gatineau River, the largest tributary of the Ottawa River. The other two plants are at Chelsea and Farmers, 26 miles below Paugan. The three plants have a designed capacity of 562,000 horsepower.

By combining the operation of the Chelsea, Farmers and Paugan developments into one system, it will be possible to utilize to the best advantage the total fall in the river for a distance of 62 miles from its mouth and to develop at least two-thirds of the available power in the whole river. The storage capacity provided by the two lakes created by the Chelsea and Paugan dams will be of material assistance in the regulation of the system and all possibility of trouble from ice should be eliminated.

Evansville, Ind., to Have New Generating Plant

Plans are under way by the Commonwealth Power Corporation, of Jackson, Mich., for a new generating station for the Southern Indiana Gas & Electric Company at Evansville, Ind., which will be known as the Ohio River Steam Plant. This station will have an ultimate capacity of 100,000 kw. The initial installation will be a 12,500-kw. Allis-Chalmers turbine and condenser.

A 7,500-kw. unit will be transferred from the old Division Street plant to the new station, leaving a capacity at the older plant of 15,600 kw. for stand-by service and as a live-steam heating plant. The low-pressure Mulberry Street heating plant ultimately will be discontinued.

The new plant will operate on a pressure of 400 lb. and a total temperature of 700 deg. F. With the initial installation two boilers will be provided, each having a capacity of 130,000 lb. of steam per hour. The boilers will be equipped with underfeed stokers water-cooling surface on the rear and two side walls, and high-pressure economizers. Part of the program for this year consists in running a new high-pressure heating main from the Division Street plant to tie on to the present low-pressure heating system through a reducing valve.

Stevens & Wood and Hodenpyl, Hardy Merge to Form Allied Light & Power Co.

With the announcement of the formation of the Allied Light & Power Company to consolidate the interests of Hodenpyl, Hardy & Company, Inc., and Stevens & Wood, Inc., public utility properties with total assets at the close of 1927 in excess of $500,000,000 will come under a single management.

This step follows closely upon those to bring about the merger of the Northern Ohio Power Company, controlled by Hodenpyl, Hardy & Company, and the Penn-Ohio Edison Company, a Stevens & Wood property.

The Commonwealth Power Corporation is the third major utility interest involved in the organization of the Allied Power & Light Company.

B. C. Cobb, chief operating official of the Commonwealth Power Corporation and other Hodenpyl & Hardy properties, will be chairman of the board of the new corporation, while Mr. Hodenpyl and Mr. Hardy will not actively participate in the operations of the new company, although having substantial investment interests in it. Mr. Hardy, it is understood, will divide his time between this and his other interests.

R. P. Stevens, president of Stevens & Wood, Inc., will be president of the Allied company, and will also be a member of the board of directors. Jacob Hekma, of Hodenpyl & Hardy, J. T. Harrington of Stevens & Wood and Landon K. Thorne, Alfred L. Loomis and H. S. Scarritt of Bonbright & Co., will be directors with Mr. Stevens and Mr. Cobb.

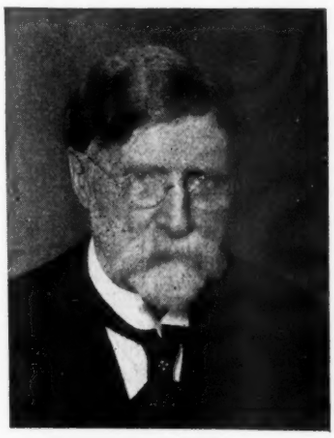
Stevens & Wood, Inc., will continue business as at present as a subsidiary company. Hodenpyl, Hardy & Company, whose staff is expected to provide most of the executive force of the allied company, will probably be dissolved not long after the consolidations referred to have been effected.

PAUL T. BRADY

Long a Leader in Electrical Development, Dies

Paul T. Brady, aged 71, associated with the Westinghouse Electric & Manufacturing Company for 34 years, and actively engaged in the electrical industry since 1881, died suddenly of heart failure on May 3 at the home of his son, Arthur J. Brady, in Portland, Oregon.

Mr. Brady was born in Cooperstown, N. Y., in 1856. In 1881 he became associated with the American Telephone & Telegraph Company and was instrumental in extending the telephone system through the Southeastern portion of New York State and at the same time, organized and built some of the first electric light plants in this district.



Paul T. Brady

In 1890, he joined the Thomson-Houston organization (which later became part of the General Electric Company) and became manager of that company's affairs in New York State and the Middle West.

In 1894 he became New York State manager of the Westinghouse Electric & Manufacturing Company, with headquarters in Syracuse. In 1907 he was transferred to New York City as special representative of the Westinghouse company, which position he held at the time of his death.

Mr. Brady assisted in the development of several important public utilities, and one of his achievements was the bringing into operation of the first 60,000-volt long-distance transmission line, outside of California, for bringing power from Niagara Falls to Syracuse.

New York Section of N.E.L.A. Holds Safety Rally

The fifth annual safety rally of employees and officials of electric light and power companies of New York, the Bronx, Westchester, Queens and Staten Island, was held under the auspices of the accident prevention committee of the Metropolitan Section of the National Electric Light Association on May 4 at Carnegie Hall. The rally was attended by more than 3,000 employees in the electric industry, and various prizes, including the Insull Medal for life-saving, were presented.

Marcus Dow, safety engineer for Vander Poel, Pausner & Jefferson, Inc., was the principal speaker of the evening and among his remarks said: "Ninety per cent of the accidents that occur in our industries and on the streets are caused by little things. Major violations of the law and spectacular acts of criminal negligence produce but a small fraction of the total number of deaths and injuries."

The Insull Medal was presented by F. W. Smith, vice-president and general manager of the United Electric Light & Power Company, to V. T. Pilsbury, an employee of the same company. The medal is presented for the saving of life by the application of the prone-pressure method of resuscitation in electric shock.

A.T.S.M. Convention to Meet June 25-29 in Atlantic City

The Chalfonte and Haddon Hall Hotels, Atlantic City, have been picked as headquarters for the thirty-first annual meeting of the American Society for Testing Materials, June 25-29. Few organizations can boast such an assortment of committees, actively engaged in practical work, as the A.S.T.M. Because of the predominating importance of these activities committee meetings and reports have a major part in this year's program as in those of previous years. More than one hundred papers and committee reports will be presented in the fourteen regular sessions, while additional time will be provided for private committee meetings.

Several of the papers and reports are of interest to *Power* readers. A. C. Fieldner, chairman of Committee D5, on coal and coke, will report on the formation of committees to study pulverization characteristics of coal, while Lincoln T. Work will compare various methods of sampling particles in moving streams of air. In another paper Mr. Work will discuss the significant factors in determining particle size.

One whole session devoted to corrosion, fatigue and properties of metals at elevated temperatures will include papers on welding of chromium alloys, testing materials at elevated temperatures and the report of the joint research committee of A.S.M.E. and A.S.T.M. on the effect of temperature on the properties of metals.

A feature of the meeting will be an address by the president, H. F. Moore, on "Hook's Law of Stress and Strain—An Address Commemorative of the 250th Anniversary of Its Announcement."

The following nominations for officers of the A.S.T.M. have been announced: For President — G. W. Thompson, chief chemist, National Lead Company, Brooklyn, N. Y.; for vice-president—K. G. Mackenzie, consulting chemist, The Texas Company, New York City; for members of executive committee—T. R. Lawson, head, Department of Civil Engineering, Rensselaer Polytechnic Institute, Troy, N. Y.; H. S. Mattimore, engineer of materials, Pennsylvania State Highway Department, Harrisburg, Pa.; P. D. Merica, director of research, International Nickel Company, New York City; Samuel Tobias Wagner, consulting engineer, Reading Company, Philadelphia, Pa.

Boiler Committee of A. S. H. & V. E. Meets in Pittsburgh

At a recent conference between the committee on the rating and selection of low-pressure heating boilers of the American Society of Heating and Ventilating Engineers and the engineers of concerns manufacturing heating boilers, the engineering and technical features of the proposed rating code were considered and methods of testing heating boilers discussed. During the conference the committee obtained the advice and help of the manufacturers' engineers and also gave to them an opportunity to discuss their common problems.

In order to facilitate discussion, the committee had prepared a book which analyzed the problem in a logical manner, starting with the principles underlying the placing of the output of boilers on a comparative basis, covering the various factors involved, and leading up to the methods and details of test.

The meeting was attended by 28 delegates representing both the committee and the manufacturer, and was held at the Pittsburgh, Pa., station of the United States Bureau of Mines.

Refrigerating Engineers Meet in Detroit June 4-7

In order to take care of a program of wide scope and to provide the local section with time to entertain members, the American Society of Refrigerating Engineers will hold a four-day convention this spring in Detroit, instead of the three-day meeting of the last few years. The program committee announces papers of unusual merit, and the Detroit Section looks forward to welcoming the largest gathering of the engineers in this field on record.

Electric refrigeration will have its innings with the technical men—in the atmosphere of the meeting place, in visits to plants where this product comes from, and in attention on the program. The committee states, however, that no less attention will go to the technical concerns of those in other fields. Particular study will be devoted to refrigerators. There will be five technical sessions for the five divisions of the Society.

Research and Applications

Tests on double-pipe coolers and condensers, surface-resistance heat transmission, multi-stage cycles and heat transmission in refrigerator cars will be heard about. Applications of refrigeration to fish freezing and to the oil industry will be presented, as well as a paper on ammonia control devices.

During the last two days refrigerators will be discussed, as well as the application of silica gel. The regular session for refrigerator men will be held on Thursday, devoted mainly to design and tests methods. The final paper on the program will be read by the president of the society and promises to be one of the most interesting, if not revolutionary—"The Use of Cracked Ice in Home Refrigerators."

The chief entertainment feature will be a banquet on Wednesday evening with a short speaking program and entertainment, followed by a dance. The local Section will also provide a number of features for men and women on different days, including two tours of inspection of the city.

A.S.M.E. Committee Formed to Investigate Radiant Heat Absorption

The first meeting of the new A.S.M.E. Special Research Committee on the Absorption of Radiant Heat in Boiler Furnaces was held on Monday, April 16, at the Engineers' Club in New York City. Prof. Walter J. Wohlenberg, Yale University, was elected chairman.

This committee is the result of a conference held previously among a large group of men from the public-utility, oil refinery and combustion equipment concerns in this country who are interested in studying the absorption of radiant heat in boiler furnaces. While a large-scale investigational program may eventually be necessary the committee at first proposes to study the results of a number of tests on radiant heat absorption that have been carried on in the past by some half dozen large public utilities.

A small committee personnel seems desirable to head up these activities, at least in the beginning, and includes E. G. Bailey, president, Fuller-Lehigh Company, Fullerton, Pa.; R. M. Gates, manager, industrial division, Superheater Company, New York; E. L. Lindseth, Cleveland Electric Illuminating Company, Cleveland, Ohio; G. A. Orrok, consulting engineer, New York; R. J. S. Pigott, consulting mechanical engineer, Public Service Production Corporation, New Jersey; and Prof. W. J. Wohlenberg, Sheffield Scientific School, Yale University.

Industrial Division, National Research Council, Holds Annual Meeting

The annual meeting of the Division was held May 4, 1928, at the Bell Telephone Laboratories. Members of the Division and their guests were given a luncheon by the Laboratories and later shown the developments in television, vitaphone and movietone. They were also afforded an opportunity to inspect some of the newest developments in the Laboratories, such as the making of single crystal material, the study of magnetic properties of permaloy, a magnetic alloy which has about twenty times the permeability of the best-grade iron, and of the developments of high-power vacuum tubes for transoceanic radio telephony.

The following officers were elected to serve for the coming year: Chairman, Elmer A. Sperry, Sperry Gyroscope; vice-chairman, Dugald C. Jackson, Prof. of Elec. Engineering M. I. T.; executive committee (in addition to above), Gano Dunn, Pres. of G. White Engineering Co.; D. S. Jacobus, Consulting Engineer Babcock & Wilcox Co.; F. B. Jewett, Vice-Pres. of American Telephone & Telegraph Co.; John Johnston, Director of Research United States Steel Corporation; W. B. Lashar, President American Chain Company; members at large, H. C. Dickinson, Chief, Division III, Heat and Thermometer, Bureau of Standards, Washington, D. C.; J. W. Lieb, vice-president and general manager, the New York Edison Company, 130 East 15th St., New York City; E. R. Weidlein, Mellon Institute, Pittsburgh, Pennsylvania.

Maurice Holland and William Spraragen continue to serve as director and secretary respectively.

Mr. Sperry presented a report of the Division's activities and pointed out that two new investigations have been satisfactorily financed, namely those dealing with heat transfer and with the welding of structural steel. The division has also been instrumental in organizing American participation in the World Engineering Congress to be held in Tokio, Japan, in 1929.

Flood Control Bill Passed by Congress

Without a record vote the Senate on May 9 adopted the conference report on the Flood Control Bill, which had been approved by the House the previous day. The measure will now go to the President for his signature.

Prior to action on the bill by the House the President called the conference to the White House and specified the further changes that would be necessary to secure his approval of the bill. These changes were approved by the conference.

In the section of the bill in which the United States is required to purchase flowage rights, the President insisted on the insertion of the word "additional"

so as to make the first sentence of the section read, "The United States shall provide flowage rights for additional destructive flood waters that will pass by reason of diversions from the main channel of the Mississippi River: provided, that in all cases where the execution of the flood control plan herein adopted results in benefits to property, such benefits shall be taken into consideration by way of reducing the amount of compensation to be paid."

By the insertion of the one word it is believed that the government will have to make no payments in the backwater areas on the lower stretches of the Red, the Yazoo, the Arkansas, the St. Francis and along the Atchafalaya. Some are of the opinion that the insertion of the additional word will mean that no payment will have to be made for lands overflowed in 1927.

The President also required an important change in section 3 of the bill, under which damages to riparian owners were to be paid, whereby such payments are limited to lands "which are not now overflowed or damaged."

The bill authorizes the expenditure of $325,000,000 for the flood control project and places final authority in the hands of the President.

The federal government will bear the entire cost of the construction of levees and other flood control works and will furnish rights of way for levees along floodways, while local interests must furnish only such additional rights of way as are needed for levees on the main channel of the Mississippi and must maintain the flood control works when completed.

A.S.H. & V.E. to Meet at West Baden Springs, Ind. in June

An active committee under the leadership of Charles R. Ammerman has been organized to make the necessary arrangements for the semi-annual meeting of the American Society of Heating and Ventilating Engineers at West Baden Springs, Ind., June 26-29.

All technical features are being planned for by the program committee headed by Prof. F. B. Rowley, Minneapolis. From the many interesting papers that have been offered twelve will be selected for presentation at the meeting. The program has been divided into three main sections, consideration being given to domestic heating by oil and gas, to air conditioning problems, and considerable time is set aside for the discussion of codes and research investigations. The codes that will come up for discussion are those on Boiler Rating and Selection, Garage Heating and Ventilating, and Air Filtering.

West Baden Springs offers many opportunities for recreation, and two golf courses are available on which a tournament will be held on Wednesday afternoon for the Research Cup. So far plans for the ladies contemplate an informal reception and dance, a bridge and tea, and a trip to one of the caves.

Coming Conventions

American Association of Engineers, annual convention, El Paso, Texas, June 4-6; M. E. McIver, secretary, 63 Adams St., Chicago.

American Boiler Manufacturers Association, annual convention, at Buckwood Inn, Shawnee-on-the-Delaware, Pa., June 11-13; A. C. Baker, secretary, 801 Rockefeller Bldg., Cleveland, Ohio.

American Institute of Electrical Engineers, annual Summer convention at Denver, Colo., June 25-29; F. L. Hutchinson, secretary, 33 West 39th St., New York City.

American Order of Steam Engineers, convention at Atlantic City, N. J., June 11-14, and exhibition with American Supplymen's Association. Address Fred L. Jahn, Watson of McDaniel Company, 146 N. Seventh St., Philadelphia.

American Society of Refrigerating Engineers, meeting at Detroit, June 4-7; W. H. Ross, secretary, 37 West 39th St., New York City.

American Society of Heating and Ventilating Engineers, Summer meeting at West Baden Springs Hotel, West Baden, Ind., June 26-29; A. V. Hutchinson, secretary, 29 West 39th St., New York City.

American Society of Mechanical Engineers, spring meeting in Pittsburgh, Pa., May 14-17; first national oil and gas power meeting at State College, Pa., June 14-16; Twin-City regional meeting at St. Paul, Aug. 27-30; Boston regional meeting, Oct. 1-3; Calvin Rice, secretary, 29 West 39th St., New York City.

American Society for Testing Materials, Atlantic City, June 25-29.

American Water Works Association. Annual meeting, Hotel Fairmont, San Francisco, June 11-16; W. M. Niesley, 170 Broadway, New York City.

Association of Iron and Steel Electrical Engineers, annual convention and Iron and Steel Exposition at Hotel Stevens, Chicago, June 25-29.

Canadian Steel and Power Show at the University of Toronto Arena, Sept. 4-7; Campbell Bradshaw, secretary, 24 Front St., West Toronto, Canada.

National Association of Power Engineers, annual convention at Detroit, Sept. 11-15, and concurrently National Exhibitors' Assn. exhibit; Fred Raven, 417 South Dearborn St., Chicago. New England States Association convention at Hartford, Conn., June 21-23; K. W. Lundberg, secretary. Foot Guard Armory, Hartford. New Jersey State convention at the Plaza Hotel, Journal Square, Jersey City, N. J., June 2-3; T. M. Gray, State Secretary, 46 West 51st St., Bayonne, N. J.

National Board of Boiler and Pressure Vessel Inspectors, meeting at Erie, Pa., June 18-20.

National Electric Light Association, Convention and exhibition, Atlantic City, N. J., June 4-8; A. Jackson Marshall, secretary, 420 Lexington Ave., New York City.

National District Heating Association, annual meeting at Ambassador Hotel, Atlantic City, June 12-15; D. J. Gaskill, sec., 112 West 4th St., Greenville, Ohio.

National Association Practical Refrigerating Engineers, annual convention at Louisville, Kentucky, Nov. 20-23; E. H. Fox, secretary, 5707 West Lake St., Chicago, Ill.

Stoker Manufacturers Association, fall meeting at Greenbrier Hotel, White Sulphur Springs, W. Va., Oct. 22-24.

Universal Craftsmen Council of Engineers, Newark, N. J., Aug. 7-10.

Second Bituminous Coal Conference will be held at Pittsburgh, Nov. 19-22.

Quebec Authorizes Half Million Horsepower Project on St. Lawrence

The Beauharnois Light, Heat & Power Company project to develop 500,000 hp. of electrical energy on the St. Lawrence River just below Montreal, which created a great deal of discussion at the recent session of the Quebec Legislature, has now been officially authorized by Order-In-Council. The order gives the company the right to divert 40,000 cu.ft. of water per second between Lake St. Francis and Lake St. Louis on the St. Lawrence, for the development of hydro-electric power, most of which will be absorbed by large industrial concerns in the immediate vicinity of Montreal.

The company has agreed to develop 100,000 hp. during the first five years, 200,000 hp. after the sixth year, 300,000 after the seventh, and 500,000 hp. at the end of ten years. One clause in the Order-In-Council provides that the company must not export to the United States any of the power it develops, either directly or indirectly, but if it is found that there is not a large enough market for its output in the province of Quebec, it is authorized to dispose of a certain amount of power in Ontario, providing that the amount thus exported does not exceed 50 per cent of the total produced.

It is estimated that by the time the project is completed, the company will have expended in the province of Quebec approximately $30,000,000.

Power Tour Will Visit Milan Edison Plants

Among the attractions to the engineers who take advantage of the opportunity afforded by the International Power Tour to visit foreign plants is the inspection of five of the plants of the Milan Edison Company (Societá Generale Italiana Edison di Elettricitá). This tour is being planned under the auspices of the Mid-West Power Conference. Two trips will be made by automobile, one to the low-head plants on the Adda River about 20 miles from Milan; the other, to the high-head plants in the Antrona Valley south of Domodossola.

The Adda River, which drains from Lake Lecco, was one of the first to be developed by the construction of the Bertini plant at Paderno. This plant, built in 1898, utilizes a head of 91 ft. and contains six horizontal units, two of which have been recently rebuilt to give the plant an aggregate capacity of 12,600 kilowatts.

The Robbiate, or Esterle, plant is a short distance below, but it takes its water from the river at a point higher up, thus utilizing the full drop of 128 ft. on six 4,600-kw. units. At the headworks of this plant there is the Calusco plant constructed to utilize the drop of 28 ft. between the headwater levels of

the Bertini and Robbiate plants. There are open flume settings for three 1,500-kw. units with four runners each. The output of these three plants, estimated to be 270,000,000 kw.-hr. in the average year, is transmitted over the historic 22,500-volt lines to Milan.

An interesting feature of the Rovesca plant is that it is supplied from three sources having heads of 2,340 ft., 1,700 ft. and 820 ft. respectively, all of which are provided with large reservoirs. Four of the five units have a capacity of 9,000 kw. each and operate at the higher heads, one of these being arranged so that it is possible to draw from either of these two sources. The fifth unit, 3,000 kw., operates at the lowest head. The Pallanzeno plant, at the foot of the Antrona Valley, contains three 9,000-kw. units, operating at a head of approximately 1,700 ft. and utilizes the discharge from Rovesca, together with water diverted at this plant from the Ovesca River.

Consumers Power Co. Enlarges Grand Rapids Plant

In an addition to the building of the Wealthy Street generating station in Grand Rapids, Mich., the Consumers Power Company is arranging to install a 20,000-kw. generating unit that will be served by two boilers and later by a third boiler when the full 20,000-kw. capacity is required. Each of these boilers will have a normal operating capacity to delivery 125,000 lb. of steam per hour and a maximum capacity of 150,000 lb. per hour. The steam conditions will be 400 lb. pressure and 725 deg. F.

The boilers will be of the cross-drum type with water walls and air preheaters but no economizers. Unit mills will supply the pulverized fuel that is to be burned. It may be recalled that the Wealthy Street plant had a capacity of 22,500 kw. in three units operating on a steam pressure of 200 lb. There will be no interchange of steam between the new and old sections of the plant. It is anticipated that the new addition will be ready for operation about June 1, 1929.

Personals

Gerard Swope, president of the General Electric Company, announces the appointment of C. W. Stone, manager of the central-station department, to the position of consulting engineer, and the selection of M. O. Troy as manager of the central-station department.

M. C. Sickel, until recently district manager for the Elliott Company, in the Chicago territory, has been transferred to Denver, Colo., where he will establish a new district sales office.

Robert Fitzgerald, until recently with the Indiana Service Corporation, at Fort Wayne, Ind., has been appointed sales manager of the Auburn Stoker Corporation, Auburn, Ind.

T. A. Cadmus, for the last two years district manager of the Kansas City office of the Elliott Company, has been transferred to San Francisco, where he will open up a new sales office for the company.

E. R. Goodridge, for two years news editor of *Power*, is now editing the *Power Specialist* and the *Asbestos Roofer*, the two house organs of the Johns-Manville Company, 292 Madison Avenue, New York City.

Business Notes

American Hoist & Derrick Company announces that on April 30, the partnership interest of W. O. Washburn in the company was purchased by Frank J. Johnson, the senior partner and one of the founders. The business will be continued as the American Hoist & Derrick Company, under the form of a corporation with the following officers: F. J. Johnson, president and treasurer; Howard S. Johnson, vice-president in charge of sales; Frederic Crosby, vice-president in charge of production.

The National Flue Cleaner Company, Inc., Groveville, N. J., announces the appointment of the following representatives: Walter G. Heacock Company, 30 Euclid Arcade, Cleveland, Ohio, and 413 Penobscot Bldg., Detroit, Mich.; Jack Deerwester Company, 1621 University Ave., St. Paul, Minn.; Charles Zinram, P. O. Box 487, Erie, Pa., and Laib Company, Louisville, Ky.

The Rollway Bearing Company, Inc., Syracuse, N. Y., announces the appointment of Alfred E. Munch, Jr., as representative in the Chicago-Milwaukee District, with headquarters at 544 Railway Exchange Building, Chicago.

The Chain Belt Company, Milwaukee, Wis., announces the election of Robert W. Baird to the board of directors to fill the vacancy caused by the death of H. O. Seymour. Mr. Baird is vice-president of the First Wisconsin Bank and the First Wisconsin Trust Company.

The Rush Machinery Company, 32 East Carson St., Pittsburgh, Pa., is now representing the Northern Equipment Company in Pittsburgh and vicinity. This company was formerly represented by the Andrew-Bradshaw Company, now merged with the Blaw-Knox Company.

Wm. A. Nugent & Co., Inc., recently announced the appointment of the following foreign sales agencies. Darling Bros., 120 Prince St., Montreal, Canada, and 1144 Homer St., Vancouver, Canada; J. Golden & Company, 10-12 Broad St. Ave., London, Eng.; Honolulu Iron Works, Honolulu, H. I.; Mr. Askew, 273 George St., Sidney, N. S. W. Australia; The Fobes Company, Ltd., C. P. O. Box 448, Shanghai, China; and the Central Commercial Company, Rarsi Bazar, Fort, Bombay, India; and Alfred Du Bois, 12 Bis Rue Des Marronier, Paris, France.

The Celite Products Company, Los Angeles, Calif., has purchased the plant and property of the National Magnesia Manufacturing Company at Redwood City, Calif. The business of the latter company, which includes the manufacture of magnesia, asbestos and diatomaceous earth insulating materials, will be continued under the name of the National Magnesia Company.

The Cement Gun Company, Inc., Allentown, Pa., announces that it is now represented in Chicago and vicinity by A. C. O'Donnell and R. N. Gillespie, with offices at 549 West Washington Street.

The Ames Pump Company, Inc., Division of Staten Island Shipbuilding

Fuel Prices

COAL

The following table shows the trend of the spot steam market in various coals, f.o.b. mines; mine run, except Pittsburgh gas slack:

Bituminous (Net Tons)	Market Quoting	Price per Ton
Navy Standard	New York	$2.35@$2.60
Kanawha	Columbus	1.25@ 1.60
Smokeless	Cincinnati	1.75@ 2.00
Smokeless	Chicago	1.65@ 2.00
S. E. Kentucky	Chicago	1.35@ 1.75
Steam	Pittsburgh	1.40@ 1.80
Gas Slack	Pittsburgh	1.15@ 1.25
Big Seam	Birmingham	1.40@ 1.75
Anthracite (Gross Tons)		
Buckwheat	New York	$2.75@$3.00
Birdseye	New York	1.60

FUEL OIL

New York—May 10, industrial use, tank-car lots, 28@34 deg., Baumé, 4¾c. per gal.; 36@40 deg., furnace, 6¼c. per gal., f.o.b. Bayonne, N. J.

St. Louis—May 3, tank-car lots, f.o.b. St. Louis, 24@26 deg., $1.52½ per bbl.; 26@28 deg., $1.57½ per bbl.; 28@30 deg., $1.62½ per bbl.; 30@32 deg., $1.67½ per bbl.; 32@36 deg., gas oil, 4.4c. per gal.; 38@40 deg., 5c. per gal.

Pittsburgh—May 1, f.o.b. local refinery, 30@34 deg., fuel oil, 5¼c. per gal.; 36@40 deg., 5¾c. per gal.

Philadelphia—May 3, 26@30 deg., $2.07 per bbl.; 13@19 deg., $1.22 per bbl.; 22 plus, $1.48@$1.55 per bbl.; 27@30 deg., $2.17 per bbl.

Cincinnati—May 1, tank-car lots, f.o.b. local refinery, 24@26 deg. Baumé, 5c. per gal.; 26@30 deg., 5¼c. per gal.; 30@32 deg., 5.95c. per gal.

Chicago—May 5, tank-car lots, f.o.b. Oklahoma, freight to Chicago, 90c. per bbl.; 22@26 deg., 80@85c. per bbl.; 26@30 deg., 90@95c. per bbl.; 30@32 deg., $1.05 per bbl.

Boston—May 7, tank-car lots, f.o.b. 12@14 deg. Baumé, 4½c. per gal.; 28@32 deg., 5.65c. per gal.

Dallas—May 5, f.o.b. local refinery, 26@30 deg., $1.40 per bbl.

Company, 90 West St., New York City, announces the appointment of the following sales representatives. Dravo-Doyle Co., 300 Penn Ave., Pittsburgh, Pa. and 805 Schaff Bldg., Philadelphia, Pa.; The Coon-De Visser Co., 2051 W. Lafayette Blvd., Detroit, Mich., and W. E. Berrington, 707 Canal Road, N.W., Cleveland, Ohio.

THE INGERSOLL-RAND DRILL COMPANY with offices at 314 N. Broadway, St. Louis, Mo., was succeeded by the Ingersoll-Rand, Inc., on May 1. A new branch, operating under the St. Louis office, has been opened at 226 West A Street, Picher, Okla. This office will serve customers in northern Oklahoma, southern Missouri, and Arkansas.

RILEY STOKER CORPORATION, Worcester, Mass., announces that it has recently acquired the Automatic Control Company, of Detroit, Mich. The latter company will continue to manufacture A.C.C.O. electric door operators for elevator doors.

THE BOILER ENGINEERING COMPANY, Newark, N. J., builder of Turner and Beco Boiler Baffle Walls has appointed Arthur H. Kennedy, 316 Glencoe Bldg., Duluth, Minn., to represent it in Minnesota, North Michigan, and North Dakota.

TRADE CATALOGS

STEEL JOISTS AND STANCHIONS—The Bethlehem Steel Company, Bethlehem, Pa., has issued a new handbook on steel joists and stanchions, to be known as Catalog S-28. The steel joists are lighter in weight than the standard beams and are adapted for use in light load floor construction and roof construction for practically all types of buildings. The stanchions are adapted for use as columns or posts in the lighter types of steel-frame construction. Details of the shapes together with tables of safe loads and spacing, weights and dimensions are included.

HIGH PRESSURE BLOWOFF VALVES—The Yarnall-Waring Company, Philadelphia, has just issued a four-page bulletin B-415 giving a list of the installations of high-pressure Yarway blowoff valves made during 1927. The list represents 73 installations and approximately 800 valves, ranging in pressure from 250 to 1,350 pounds.

AIR PREHEATER—The Blaw-Knox Company, Pittsburgh, Pa., has issued bulletin No. 1040, entitled "1,500 Degrees Air Without Checkers," in which the features of its regenerative air heaters, as applied to the steel and glass industry, are presented. Illustrations of installations where air temperatures of 1,200 and 1,400 deg. are obtained, are included.

PRESSURE-REDUCING VALVES — The Spence pressure reducing valves with outside auxiliary control are illustrated and described in a bulletin issued by the Spence Engineering Company, Inc., 110 East 42nd St., New York City. A capacity chart designed to show the capacity of the reducing valves at various inlet and discharge pressures is included.

USE OF CELITE IN CONCRETE—This subject is extensively treated in bulletin No. 337 recently issued by the Celite Products Company, Los Angeles, Calif. Directions for using this material, which is designed to improve the workability and increase the watertightness of concrete, is covered in detail.

MECHANICAL TRANSMISSION—A comprehensive catalog, No. 46, on mechanical transmission devices has been issued by the Philadelphia Gear Works, Philadelphia, Pa. This is of pocket size and describes the full line of gears, sprockets, chain drives and reduction gears manufactured by this company.

NEW PLANT CONSTRUCTION

Compiled by the McGraw-Hill Business News Department, which is prepared to furnish a more complete daily service to those who wish it

Calif., Los Angeles—E. Small & Associates are having preliminary plans prepared for a 13 story apartment including steam heating system, electric elevators, etc., at Rossmore and Rosewood Aves. Estimated cost $800,000. Walker & Eisen, Western Pacific Bldg., are architects.

Calif., Los Angeles—Syndicate, headed by S. H. Woodruff, H. Chandler, and G. Beesemeyer of Guaranty Bldg. & Loan Assn., plans the construction of a hotel. Estimated cost $1,000,000. G. B. Kaufmann, 610 Union Bank Bldg., is architect.

Calif., San Diego—Bureau of Yards & Docks, Navy Dept., Washington, D. C., plans the construction of a salt water pumping station at Naval Operating Base (Air Station) here.

Calif., San Francisco—Pacific Gas & Electric Co., 245 Market St., awarded contract for the construction of a compressor plant on North Beach St., to H. H. Larsen, 68 Post St. Estimated cost $25,000.

Calif., San Francisco — San Francisco Advertising Club, Call Bldg., is having plans prepared for a 20 story office building at Belden and Bush Sts. Estimated cost $1,000,000. D. Stone, 354 Hobart St., Oakland, is architect.

Conn., New Haven—United Illuminating Co., 84 Temple St., will soon award contract for the superstructure of a power plant. Estimated cost $3,000,000.

Ga., Barnesville—City plans the construction of a 500,000 gal. filtration plant and pumping station. Estimated cost $30,000. Weideman & Singleton, Candler Bldg., Atlanta, Ga., are engineers.

Ill., Chicago—By Product Coke Corp. and Peoples Gas Co., plan the construction of a boiler house at 10839 Carondolet Ave. Estimated cost $155,000.

Ill., Chicago — Holabird & Root, 333 North Michigan Ave., Archts., will receive bids until May 21 for a 16 story office and stores building, including elevators, etc., at Walton Pl. and Michigan Ave., for Palmolive Peet Co., 360 North Michigan Ave. Estimated cost $2,500,000.

Ill., Highland Park—Village will receive bids about June 1 for a water filtration plant and pumping station. Estimated cost $300,000. Pearse, Greeley & Hansen, 6 North Michigan Ave., Chicago, are engineers.

Ill., Urbana—University of Illinois will soon award contract for a group of college buildings. Estimated cost $1,000,000. J. M. White, Administration Bldg., is supervising architect and engineer.

Ind., Edinburg—City will receive bids until May 21 for the construction of a power house. Estimated cost $40,000.

Ind., South Bend — Water Dept. has a program for 1928 for increasing water supply including sinking of three wells and additional pumping station. Later it is planned to build a 6 m. gal. reservoir, etc. Estimated cost approximately $500,000. B. J. McCaffrey is superintendent.

Mass., Belmont (Boston P. O.)—Arlington Gas Light Co., 689 Massachusetts Ave., Arlington, is having plans prepared for the construction of a gasometer, heater and governor house at Brighton and Hittenger Sts. Estimated cost $95,000. The Gas, Electric & Improvement Assn., 77 Franklin St., Boston, is engineer.

Mass., Boston — Institutions Dept. will soon award contract for a boiler house at Long Island Hospital.

Mass., Bridgewater — Bd. of Education, State House, is having plans prepared for rebuilding power house at State Normal School. Estimated cost $80,000. E. D. Kimball Co., 6 Beacon St., Boston, is engineer.

Mass., Cambridge (Boston P. O.)—City, J. J. Scully, City Hall, Chn., Water Bd., is having sketches made for the construction of a pumping station at Lake View Ave. and Worthington St. Estimated cost $100,000.

Mass., Dorchester (Boston P. O.)—Boston Ice Co., C. D. Russell, 110 State St., Boston, awarded contract for the construction of an ice plant at Dewar and Aukland Sts. here to Vappi & Ferguson, 522 Massachusetts Ave., Cambridge. Estimated cost $40,000.

Mass., Hyde Park (Boston P. O.)—Edison Electric Illuminating Co., 39 Boylston St., Boston, is having plans prepared for addition to sub-station on Fairmount Ave. here. Estimated cost $40,000.

Mass., Roxbury (Boston P. O.)—Boston Elevated Railway Co., 552 Harrison Ave., Boston, will build a power sub-station on Warren St. by day labor here. Estimated cost $40,000.

Mass., Wilmington—Town, C. S. Harriman, Comr., is receiving bids for the construction of a pumping station. Estimated cost $40,000.

Mich., Ann Arbor—Ann Arbor Savings Bank, is having plans prepared for an 8 story hotel and bank building at Main and Huron Sts. Estimated cost $1,000,000. Pond, Pond, Martin & Lloyd, 6 North Michigan Ave., are architects.

Mich., Detroit—Chevrolet Motor Car Co., Holbrook Ave., awarded contract for addition to power house, 32 x 45 ft. to Everett Winters Co., 1651 East Grand Blvd. Estimated cost $50,000.

Mich., Pontiac—J. Kovinsky, Peoples State Bank, North Saginaw St., awarded contract for a 14 story bank and office building on North Saginaw St. to Everett Winters Co., 1651 East Grand Blvd., Detroit. Estimated cost $1,000,000. Steam heating and ventilation systems, boilers, elevators, etc. will be installed.

Minn., Minneapolis—Marvin Realty Co., A. L. Selcer, Secy. and Treas., 34 South 4th St., is having plans prepared for a 6 and 7 story hotel including steam heating and electric refrigeration systems, etc., at West Lake St. and Dean Blvd. Estimated cost $900,000. S. J. Bowler, 619 Kasota Bldg., is architect.

Mo., St. Louis—Union Electric Light & Power Co., 12th and Locust Blvds., awarded contract for an electric power sub-station at Clark Ave. and 14th St. to Fruin-Colnon Contracting Co., Merchants-Laclede Bldg. Estimated cost $200,000.

Neb., Omaha—Kitchen Bros. Hotel Co., awarded contract for an 11 story hotel at 14th and Farnam Sts. to Selden-Breck Construction Co., 205 Arthur Bldg. Estimated cost $2,000,000.

Neb., Omaha—Union Pacific R.R. Co., 15th and Dodge Sts., is having plans prepared for a 12 story office building. Estimated cost $1,000,000. G. J. Adamson, is Asst. Chief Engineer.

N. J., Hawthorne (Paterson P. O.)—City, A. C. Evans, Comr. of Road and Water Dept., appropriated $70,000 for waterworks improvements including new wells, pumping equipment, etc.

N. J., Jersey City—Public Service Electric & Gas Co., 80 Park Pl., Newark, awarded contract for the construction of an electric sub-station at Sip and Whitman Aves. here to James Mitchell Inc., 40 Journal Sq., Jersey City. Estimated cost $60,000.

N. J., Kearny—Delaware Lackawanna & Western R.R., 90 West St., New York, N. Y., plans the construction of a power station here. Estimated cost $4,250,000. G. J. Ray, Hoboken, N. J., is chief engineer.

N. J., West Orange—Public Service Electric & Gas Co., 80 Park Pl., Newark, will build a switching station, 132,000 v. capacity on Mount Pleasant Ave. Estimated cost $150,000. Public Service Production Co., 80 Park Pl., Newark, is architect and engineer.

N. Y., New York—American Exchange Irving Trust Co., 60 Broadway, is having preliminary plans prepared for a 46 story office building at Broadway and Wall St. Estimated cost $15,000,000. Architect not selected.

N. Y., New York—B. B. Davis & Co., 3 East 44th St., will build a 14 story loft building at 584 Broome St. Estimated cost $2,000,000. W. Higginson, 101 Park Ave., is architect. Work will be done by separate contracts.

N. Y., New York—Jewish Memorial Hospital, I. Schweitzer, Pres., Dyckman St. and River Rd., had plans prepared for a 9 story hospital at 4614 Broadway. Estimated cost $1,400,000. C. B. Meyers, 31 Union Sq., is architect.

N. C., Charlotte—A. & P. Grocery Co., awarded contract for the construction of a warehouse and cold storage plant at 900 West Hill St. to J. A. Jones Construction Co.

O., Cincinnati—Christ Hospital, Auburn Ave., awarded contract for an 8 story hospital to Ferro Concrete Co., Elm St. Estimated cost $1,500,000.

O., Dayton—Dayton Power & Light Co., 20 South Jefferson St., is having plans prepared for the construction of a steam heating plant on Eaker St. Estimated cost $300,000. Private plans.

O., Shaker Heights (Cleveland P. O.)—Jewish Orphans Home, c/o E. Joseph, 705 Union Trust Bldg., Cleveland, will receive bids about May 22 for a group of buildings at North Woodland Rd. here. Estimated cost $1,500,000. Morris & Weinberg, 3806 Euclid Ave., are architects.

Okla., Oklahoma City—Arctic Ice Co., 2 East 10th St., had plans prepared for a 60 ton electrically operated raw water ice plant at 23rd and Lottie Sts. Estimated cost $75,000. Private plans.

Pa., Philadelphia—L. Cahan, Bankers Trust Bldg., awarded contract for a 27 story apartment building at 19th and Rittenhouse Sts. to E. Thompson Co., 1955 Locust St. Estimated cost $700,000.

Tex., Brownsville—City, A. B. Cole, Mayor, plans the construction of an electric sub-station at 10th and Adams Sts. Estimated cost $25,000.

Tex., Dallas—E. Titche-Goettinger Co., plans the construction of an 8 or 10 story department store on St. Paul, Main and Elm Sts. Estimated cost $1,000,000. H. M. Green & Co., Santa Fe Bldg., are architects.

Tex., Denton—City plans an election soon to vote $35,000 bonds for the construction of an ice plant.

Tex., San Angelo—B. B. Hall, West Texas Lumber Co., will receive bids about May 18 for a 12 story hotel. Estimated cost $750,000. B. M. Morgan & Associates, San Angelo, National Bank Bldg., are architects.

W. Va., Charleston—C. K. Payne, et al., are having plans prepared for a 16 story office building at Capitol and Virginia Sts. Wysoug & Bengston, are architects.

Wis., Milwaukee—International Harvester Co., 784 Park St., awarded contract for the construction of a boiler house to Worden Allen Co., 208 South La Salle St., Chicago, Ill.

B. C., Nelson—City awarded contract for extensions and improvements to power plant including penstock, etc., to Stuart Cameron & Co. Ltd., 543 Ganville St., Vancouver. Estimated total cost $230,000. Contract for equipment awarded.

B. C., Victoria—British Columbia Electric Ry. Co. Ltd. is having plans prepared for the construction of a new central receiving and distribution station at Government and Douglas Sts., to receive power at 60,000 v. from Jordan River and to be stepped down to various voltages, capacity 20,000 kw. Estimated cost $250,000. G. M. Tripp, 1684 Yale St., is engineer.

Ont., Toronto — Queens Park Plaza, Avenue Rd. and Bloor St., awarded contract for a 15 story apartment hotel to J. W. Butler Construction Co., Royal Bank Bldg. Estimated cost $2,000,000. Steam heating system, elevators, etc. will be installed.

Que., Montreal—H. M. Caiserman & H. Rider, c/o Campbell & McMaster, 189 St. James St., plan the construction of an office and warehouse on St. Lawrence St. Estimated cost $1,500,000.

Equipment Wanted

Boilers—Purchasing and Contracting Office, Ft. Hayes, Columbus, O., will receive bids until May 21 for two boilers.

Boilers, Motor, etc.—Hygienic Coat & Towel Co. Ltd., 115 Dorchester St. W., Montreal, Que., is in the market for one 40 and one 100 hp. steam boilers, one 20 hp. electric motor, etc.

Electrical Equipment — Bd. of Public Works, Seattle, Wash., will soon receive bids for electrical equipment including waterwheel, 25,000 kw. generator, switches, etc., for third unit of hydro-electric generating plant at Gorge Creek as part of Skagit River power development, to cost $500,000.

Engines—U. S. Engineer Office, Savannah, Ga., will receive bids until May 16 for a 2 cylinder internal-combustion engine.

Power Equipment — City of Edinburg, Ind., will receive bids until May 21 for equipment for proposed power house.

Pump—City of Lindsay, Calif., is receiving bids for either one 800 g.p.m. 120 ft. head or one 600 g.p.m., 120 ft. head belt drive centrifugal pump, etc., for proposed waterworks improvements.

Pumping Equipment — City, c/o A. C. Evans, Comr. Road and Water Dept., Hawthorne, N. J., plans to purchase pumping equipment, etc., for proposed waterworks improvements.

Pumping Equipment—City of Bismarck, Mo., plans the installation of pumping equipment, etc., for proposed waterworks improvements.

Pumping Equipment—City of Cambridge, Mass., J. J. Scully, City Hall, Chn. Water Bd., plans to purchase pumping equipment for proposed pumping station.

Pumping Equipment—City of Libertyville, Ill., will receive bids until May 22 for pumping equipment, etc., for proposed waterworks improvements. Estimated cost $55,000.

Pumping Equipment — Town Council, Mount Dora, Fla., will receive bids until June 5, for pumping equipment, etc., for proposed waterworks improvements.

Pumps—City of Erick, Okla., plans to purchase centrifugal pumps, etc., for proposed waterworks improvements. Estimated cost $105,000.

Pumps, etc.—City of Wister, Okla., plans to purchase pumps, etc. for proposed waterworks improvements. Estimated cost $31,000.

Pumps, etc.—Director of Purchase and Sales, Dept. of Agriculture, Washington, D. C., will receive bids until May 25, for 13 gasoline pumps, etc.

Pumps, etc.—George B. Eggleston & Co., Central Trust Bldg., San Antonio, Tex., plans to purchase pumps, etc., for proposed oil bunkerage system at Corpus Christi, Tex. Estimated cost $75,000.

Pumps and Motors — City of Hominy, Okla., is receiving bids for two 250 g.p.m. centrifugal pumps and motors for proposed waterworks improvements.

Switches, Coils, Insulators, etc.—Dept. of Public Works, Wellington, N. J., will receive bids until July 10, for one set air brake switch with operating gear and earthing switch; stick operated disconnects; one set choke coils; one steel structure complete with strain and post insulators busbars connections, connectors, tees and foundation bolts; 2 Post type insulators for air break switch.

Industrial Projects

Calif., Brentwood—PACKING PLANT—Balfour-Guthrie Co., 351 California St., San Francisco, is having plans prepared for a 1 story, 76 x 150 ft. plant here. Private plans.

Calif., Los Angeles — ASSEMBLY PLANT—Willys-Overland Automobile Co. is having preliminary plans prepared for a 1 story assembly plant on Randolph St. between Riverside and Garfield Aves. Estimated cost $1,500,000. Austin Co. of California, 777 East Washington St., is architect.

Calif., San Francisco — FACTORY and WAREHOUSE — International Harvester Co., 201 Potrero Ave., awarded contract for a 2 story factory and warehouse at 15th and Potrero Ave., to J. H. Hjul, 128 Russ St. Estimated cost $45,000.

Conn., Westchester—BOX FACTORY—C. H. Norton Inc., F. H. Norton, Pres., plans to rebuild paper box factory recently destroyed by fire. Estimated cost $40,000. Private plans.

Kan., Kansas City—ABATTOIR BUILDING—Cudahy Packing Co., 1321 Jones St., Omaha, Neb., awarded contract for a 6 story building to Miller-Stauch Construction Co., 503 Railway Exchange Bldg. Estimated cost $400,000.

Md., Baltimore—FABRICATING SHOP, Etc.—Bethlehem Steel Co., Bethlehem, Pa., will soon award contract for a 1 story, 163 x 600 ft. fabricating, pattern and machine shops at Key Highway here. H. V. Bisbee, is supervising architect.

Mo., Kansas City — PRODUCE TERMINAL—United States Cold Storage Co., 550 East Third St., plans the construction of a produce terminal. Estimated cost $1,500,000. Private plans.

Mo., St. Louis—WAX PAPER FACTORY—Waxide Paper Co., Berkowitz Ave., and 20th and Tracy Sts., Kansas City, will soon receive bids for a 1 story, 150 x 267 ft. wax paper plant at Newstead St. between Race Course and Hunt Aves. Estimated cost $250,000. L. Haeger, 3844 Utah Pl., St. Louis, is architect.

N. J., Bayonne—BOLT PLANT—Bayonne Bolt Corp., E. L. Rupf, Pres., Trash Ave. and Second St., plans the construction of a 1 story plant on First St. Estimated cost $100,000. Architect not selected.

N. J., Passaic—PAPER BOX FACTORY—Victory Paper Box Co., 753 Main St., will build a 1 story, 118 x 142 ft. factory at 70-78 Liberty St. Estimated cost $55,000. Preiskel & Skvarla, 2 Lexington Ave., are architects.

O., East Liverpool—FOUNDRY—Patterson Foundry & Machine Co., plans the construction of a 110 x 300 ft. foundry on East End Ave. Estimated cost $50,000.

Okla., Oklahoma City — AUTO BODY FACTORY—Hickman Smith Co., 12 West 6th St., awarded contract for a 3 story, 75 x 140 ft. factory on Broadway, to C. M. Dunning, 420 North Hudson St. Estimated cost $150,000.

Pa., Neville Island (Pittsburgh P. O.)—PLANT—Dravo Contracting Co., will build a 1 story, 100 x 142 ft. addition to plant. Estimated cost $40,000. Private plans. Work will be done by separate contracts.

Pa., Philadelphia — ELECTRIC LIGHTING EQUIPMENT FACTOR—J. C. Kahn, Morris Bldg., plans the construction of a 2 story, 60 x 277 ft. factory at Westmoreland and Stokley Sts. E. A. Stopper, 10 South 18th St., is architect. Welsbach Street Lighting Co., 1934 Market St., lessee.

Pa., Pittsburgh—SAFETY APPLIANCE FACTORY — Mine Safety Appliance Co., Braddock Ave., awarded contract for a 1 and 4 story, 80 x 100 ft. factory on Meade St., to Taylor Meyer Co., Keyston Bldg. Estimated cost $90,000.

Tex., Stinnett — CARBON BLACK PLANTS — Kosmos Carbon Co., Union Bldg., Charleston, W. Va., plans the construction of two carbon black plants at Stinnett and Sanford. Estimated cost $150,000 each. J. H. Alexander, c/o Owner, Borger, is architect.

Ont., Fort William — PAPER MILL — Backus Brooks Co., 1100 Builders Exchange Bldg., Minneapolis, Minn., plans the construction of a paper mill, 100,000 ton capacity. Private plans.